THE PROFICIENCY PUZZLE:

MAINTAINING AIRMANSHIP IN AMERICA'S MOBILITY FORCE SINCE 9-11

BY

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14. ABSTRACT

This study analyzes the future of pilot training for mobility air forces in a fiscally constrained environment with de-escalating missions congruent with the drawdown in central Asia. The author begins by providing a background on the approximately two years of flight training a pilot endures to become a C-17 pilot and the requirement to continue developing a new pilot. Then the author provides a structure, based on Dr. Tony Kern???s airmanship model, to start piecing together the ???proficiency puzzle??? of the future. This leads the author to the fiscal environment of 2013 and the effect on flying hours in the C-17 community. Additionally the author discusses the technology mediums the C-17 community can leverage more efficiently in the future. These technology mediums provide options for retaining and improving proficiency, but are not a direct replacement for hands-on flying in the aircraft. The analysis provides recommendations for the future and areas for further research to gain training efficiency and effectiveness in the C-17. These recommendations focus on leadership, culture, and mission requirements. The Air Force???s investment in a new pilot requires further development, and Air Mobility Command must lead and train these pilots in the future.

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DISCLAIMER

The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, the United States Air Force, or Air University.

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ABSTRACT

This study analyzes the future of pilot training for mobility air forces in a fiscally constrained environment with de-escalating missions congruent with the drawdown in central Asia. The author begins by providing a background on the approximately two years of flight training a pilot endures to become a C-17 pilot and the requirement to continue developing a new pilot. Then the author provides a structure, based on Dr. Tony Kern's airmanship model, to start piecing together the "proficiency puzzle" of the future. This leads the author to the fiscal environment of 2013 and the effect on flying hours in the C-17 community. Additionally the author discusses the technology mediums the C-17 community can leverage more efficiently in the future. These technology mediums provide options for retaining and improving proficiency, but are not a direct replacement for hands-on flying in the aircraft. The analysis provides recommendations for the future and areas for further research to gain training efficiency and effectiveness in the C-17. These recommendations focus on leadership, culture, and mission requirements. The Air Force's investment in a new pilot requires further development, and Air Mobility Command must lead and train these pilots in the future.

CONTENTS

Illustrations

INTRODUCTION

Education and training are the foundation of our airpower advantage. To maintain this advantage in the future, we must safeguard and reinforce that foundation. All Airmen, whether teacher or student, have a role in ensuring that we remain the most technically proficient, best-educated, and best-trained air force in the world.

A Vision for the United States Air Force, 2013

In January of 2012 President Barack H. Obama and the Department of Defense crafted "Sustaining U.S. Global Leadership: Priorities for 21st Century Defense."[1] This strategic guidance focused the Department of Defense on a renewed strategy for today's fiscally constrained environment. The diverse mission areas discussed in the Defense Strategic Guidance require a joint force well trained and flexible to adapt to multiple missions. In the future, the United States military must increase force effectiveness while increasing efficiency, especially fiscally; and "powered by Airmen, fueled by innovation,"[2] the Air Force is posturing for this strategy.

The Air Force's foundation is readiness and training. Despite fiscal constraints, the Air Force must train Airmen to focus on core functions, maintain Global Vigilance, Global Reach, and Global Power, and "fly, fight, and win." Training is at the core of the Air Force's mission and vision, with flying training as an integral component. Flying training is executed according to Air Force Instruction, which stipulates, "The USAF Aircrew Training Program (ATP) ensures all aircrew members obtain and maintain the certification/qualification and proficiency needed to effectively perform their unit's mission."[3] To gain and maintain qualification and proficiency the Air Force utilizes classroom instruction, simulator sorties, training flights, and actual missions.

As the Department of Defense starts to transition from the war in the Middle East to a period of peace and reconstitution, training and readiness must be a priority. In the Mobility Air Force (MAF) the operations tempo will remain steady until the end of the War in Afghanistan. As the cargo and refueling missions subside, the operational flying

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[1] Department of Defense. "Sustaining U.S. Global Leadership: Priorities for 21st Century Defense." *Defense Strategic Guidance,* 4 January 2012. http://www.defense.gov/news/defense_strategic_guidance.pdf, 1.

[2] Gen Mark A. Welsh, III., "A Vision for the United States Air Force." E-mail. Washington, DC, 10 January 2013, 1.

[3] Air Force Instruction (AFI) 11-202 Volume 1, *Aircrew Training*, 22 November 2010, 3.

hours, mostly funded by the Transportation Working Capital Fund (TWCF), will diminish; and operational mission training will decrease by almost half from what the MAF has experienced over the past 12 years. "TWCF is a revolving fund for defense transportation. It models a customer-seller relationship between the provider [United States Transportation Command] (USTRANSCOM) and the customer (services or geographic commanders)."[4] The Working Capital Fund provides flexibility and responsiveness to meet surge and readiness requirements in peace and war for USTRANSCOM.[5] MAF missions, funded by TWCF, will experience a significant decrease in accordance with USTRANSCOM's prediction of an almost two thirds drop in cargo missions.[6] The consistently high operations tempo since 11 September 2001, has caused scheduling and continuation-training difficulties, but provided aircrews a foundation of experience, seasoning, and proficiency. The decrease in mission hours could affect crews' experience, judgment, motor-skill functions, and therefore overall flying proficiency.

Defining proficiency is difficult and subjective, but most pilots can determine when they were not proficient or flew with someone who was lacking proficiency. Successful flying training events, for example, takeoffs, landings, low-level missions, and air-refueling, are measures the flying community uses to determine proficiency. The measured frequency and volume of these events establish flying currency and attempt to provide minimum proficiency but present problems in assessing readiness across all skill levels. Achieving flight proficiency is a different process for every pilot and requires diverse mediums (aircraft, simulator, computer training and personal study) and individualized frequencies. Despite proficiency's subjectivity, the Air Force directs that "the unit commander will ensure each crewmember receives sufficient continuation

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[4] Gen William M. Fraser, III., "USTRANSCOM 2011 Annual Report." United States Transportation Command (USTRANSCOM). http://www.transcom.mil/documents/annual_reports/FY2011_USTRANSCOM_Annual_Report.pdf, 18.
[5] Secretary of the Air Force. "Air Force Working Capital fund FY 2011 Budget Estimates." Office of the Secretary of the Air Force for Financial Management. http://www.saffm.hq.af.mil/shared/media/document/AFD-100129-089.pdf, 64.
[6] Donna Miles, "Transcom Strives to Preserve Capacity to Meet Future Needs," *American Forces Press Service*, 12 November 2012, http://www.defense.gov/news/newsarticle.aspx?id=118495 (accessed 22 January 2013).

training to maintain individual proficiency."[7] A commander, however, can argue that only the individual or crew can truly comprehend when they are proficient; and with self-deception in play, even this appraisal could be in error.
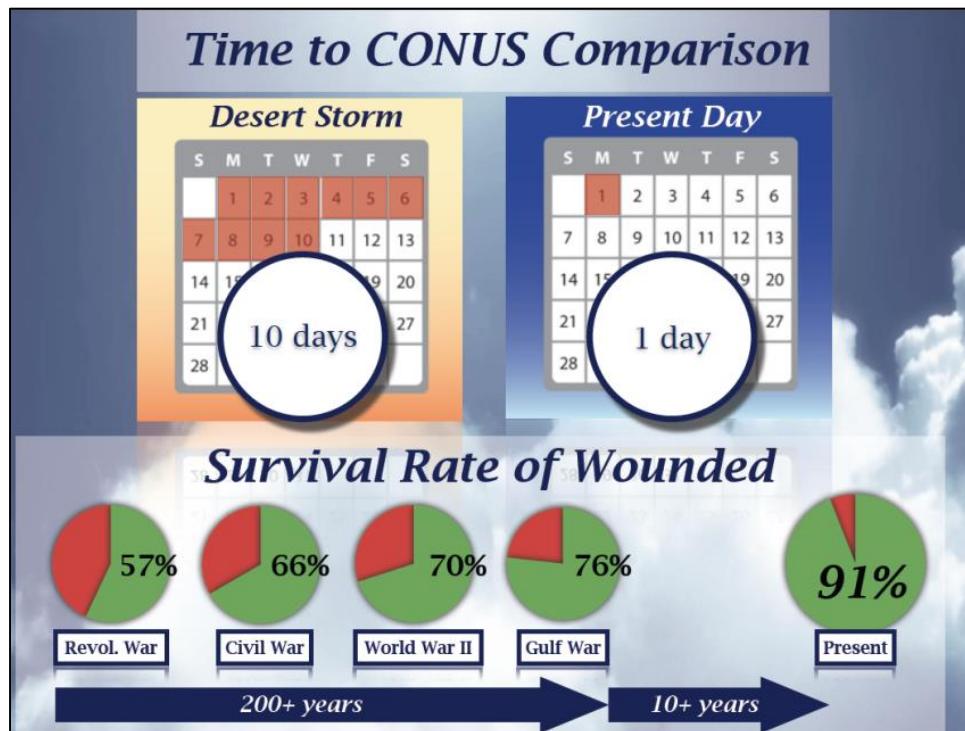
Figure 1. Aeromedical Evacuation's History

Source: Reprinted from AMC, Commander's Action Group, "Command Brief – Aeromedical Evacuation" (AMC, Scott Air Force Base, IL, 18 March 2013).

Pilot proficiency is integral in all of the MAF's missions. One unique mission is Air Mobility Commands' (AMC) aeromedical evacuation. C-17s can be configured to transport a critically wounded patient to intensive care units around the world. Since 11 September 2001, these unique operations combined with medical advances demonstrated the ability to evacuate a patient within 24 hours to the United States with a greater than 90-percent survival rate, as seen in Figure 1. AMC commanders at different echelons, the Air Force, and Congress use these figures to demonstrate their commitment to the men and women of United States Military. Proficient pilots produced by intense training

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[7] Air Force Instruction (AFI) 11-2C-17 Volume 1, *C-17 Aircrew Training*, 1 June 2012, 27.

are required to achieve aeromedical success; it involves many of the most difficult mission sets a mobility pilot can perform.

Setting the Stage

On 3 July 2007, a C-17 aircrew departed from an undisclosed location in southwest Asia on a routine cargo mission to Balad Air Base, Iraq, which quickly changed into a critical aeromedical evacuation of an Army Sergeant with an enemy knife lodged in his head.[8] The crew landed in Balad and prepared for two air refuelings during its non-stop flight to Andrews Air Force Base, Maryland. The crew loaded the critical patient and embarked on a non-stop flight to Andrews to save a soldier's life. After a challenging first air-refueling attempt was unsuccessful, the crew determined it had carried enough extra fuel from Balad to continue the flight with only one remaining air refueling over Mildenhall Air Base, England. Following a successful air refueling over Mildenhall, the remainder of the flight proceeded smoothly and the crew completed its mission landing at Andrews Air Force Base on 4 July 2007. The Army Sergeant was carried from the C-17 within 5 minutes and rushed to nearby National Naval Medical Center, Bethesda, Maryland. Through the coordination of Air Mobility Command's Tanker Airlift Control Center (TACC), the C-17, KC-135 Stratotankers, and aeromedical professionals, the Soldier returned from the Iraqi area of operations (AO) to medical care in the United States within 24 hours of the time of the injury, helping to save his life.[9] This aeromedical evacuation is an example of daily operations for C-17 crews.

Imagine a theoretical aeromedical evacuation mission in 2013. The crew is dispatched from its deployed location at night to fly a night-vision-goggle (NVG) low-level airdrop on its way to a forward operating base (FOB) where an NVG assault

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[8] Gen Arthur J. Lichte, Commander, Air Mobility Command, "Air Mobility Command Update" (address, Air Force Association Convention, Washington, DC, 26 September 2007), http://www.afa.org/events/conference/2007/scripts/space-lichte.pdf, (accessed 18 March 2013).

[9] Capt Teresa Sullivan, "Mobility Team Answers Call for Critically Injured Soldiers," *Airlift/Tanker Quarterly (A/TQ)* 15, no. 4 (Fall 2007): 19, http://www.atalink.org/ATQ/Issues/ATQ_Fall_2007.pdf (accessed 18 March 2013).

landing is required.[10]   On the first approach, the pilot flies the C-17 into an unsafe position to land and executes a go-around procedure forcing him to return for another landing attempt. The crew's go-around is the correct decision, but has repercussions. The go-around and second assault-landing attempt cost approximately 10 minutes[11] and $2,293.[12] This financial cost is minimal, but the time is critical, especially to a wounded soldier. Additionally, the landing failure risks further exposure to enemy ground threats, endangering the safety of the crew and a $202.3 million aircraft. [13]

After completing a safe go-around and accomplishing a night-vision-goggle assault landing, the crew learns its outbound mission has changed and it will fly non-stop to Andrews Air Force Base on an aeromedical evacuation. The warrior's unique injury requires specialized treatment and the mission must fly directly to the United States, similar to the 2007 soldier's situation. Due to the original mission itinerary requiring an extended flight-duty period beyond 16 hours and an air-refueling event occurring after 14 hours, [14] the deployed squadron commander augmented the crew with two aircraft commanders and one copilot.[15] The crew's augmentation facilitates Tanker Airlift Control Center's flexibility to dispatch the crew on a critical medical evacuation mission.

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[10] Air Force Instruction (AFI) 11-2C-17 Volume 1, *C-17 Aircrew Training*, 1 June 2012, 120. "Assault Landing—an assault landing is a full flap landing with immediate and maximum effort breaking after main wheel touchdown in the designated landing zone."

[11] Maj Brian J. Smith (C-17 Weapons School Instructor Pilot, US Air Force), in discussion with the author, 18 March 2013.

[12] Department of the Air Force, "A4-1 Logistics Cost Factors" (U) Air Force Portal, Financial Management, AFI 65-503, Cost Factors: Factors Tables, https://www.my.af.mil /gcss-af/USAF/ep/browse.do?categoryId=p6925EC163B560FB5E044080020 E329A9&channelPageId=s6925EC1350500FB5E044080020E329A9 (accessed 19 March 2012). (Restricted to Common Access Card access to the Air Force Portal, U.S. Government Civilian, U.S. Military member or ally, or contractor supporting military efforts is eligible to create an account.) The FY 2013 C-17 flying hour cost is $13,758; therefore, 10 minutes of flight time equals $2,293.

[13] Department of the Air Force, "C-17 Globemaster III," Fact Sheet, 29 December 2011, http://www.af.mil/information/factsheets/factsheet.asp?id=86 (accessed 18 March 2013). "Unit Cost: $202.3 million (fiscal 1998 Constant dollars)"

[14] Air Force Instruction (AFI) 11-2C-17 Volume 3, *C-17 Operations Procedures*, 16 November 2011, 25. "3.7.1. Flight Duty Period (FDP) – FDP is the period of time starting at mission report time and ending immediately after the aircrew completes the final engine shutdown of the day. SQ/CCs [Squadron Commanders] shall form air-crews based on worst-case FDP in the mission directive."

[15] AFI 11-2C-17 Volume 3, *C-17 Operations Procedures*, 26.

Two air refuelings are required for the non-stop flight. With the planning complete, the crew executes a smooth NVG takeoff from the remote location. The two aircraft commanders struggle through the first air refueling, but complete it with enough fuel to reach the second air refueling. Fatigue sets in, but the crew presses forward with the critical mission, relying on training and experience to continue for the second air refueling. The second air refueling is not successful; the pilots were unable to obtain the required fuel load due to proficiency and adjusted their destination to a base in Europe. This divert could be life-threatening to the patient, and the crew's ability to complete the mission to Andrews due to flight-duty-period restriction is doubtful.

The pilot in this scenario executed a go-around on the first assault-landing attempt and then could not accomplish the second air refueling. Fatigue may cause these failures, but a deficiency of quality training in a C-17 and specific mission sets could also lead to a lack of pilot proficiency. The pilot in this scenario could have completed his last three 45-day-currency air-refueling-training events in the simulator and therefore not flown an air-refueling mission in the aircraft for almost five months. In addition, the pilot may have accomplished his last NVG assault landing in the simulator six months before and last daytime assault landing in the aircraft three months before or more. According to regulation, the pilot was proficient, but in this scenario, he was unable to accomplish the mission.[16] While this scenario is fictitious and may never transpire, the risk of an event like this occurring is growing, along with the inability to accomplish one of Air Mobility Command's critical missions: aeromedical evacuation.

This scenario highlights the difference between the definitions of personal proficiency. Dr. Tony Kern defines personal proficiency as a personal responsibility that can go beyond the established minimums of the flying organization or business.[17] The Air Force defines aircrew members as "proficient when they can perform tasks at the minimum acceptable levels of speed, accuracy, and safety."[18] The C-17 pilot had completed the minimum number of currency events to fulfill the Air Force Instruction

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[16] AFI 11-2C-17 Volume 1, *C-17 Aircrew Training*, 35-41. Table 4.4 C-17 Pilot Semi Annual Continuation Training Flying Requirements (see appendix A).
[17] Tony Kern, *Redefining Airmanship,* (New York, NY: McGraw-Hill, 1997), 60-61. Dr. Kern is a retired Air Force command pilot with flight experience in multiple aircraft.
[18] AFI 11-202 Volume 1, *Aircrew Training*, 24.

definition of proficiency, but failed to take the personal responsibility Kern alludes to in his study. The pilot knew the Air Force Instruction proficiency requirements and was by regulation considered current. Conversely, the pilot needed to ensure individual proficiency and failed, or was not provided the opportunity, to complete any additional events required before embarking on a mission. Furthermore, the needed proficiency training cannot be "just in time" training; there would simply be no time for practice sorties once the actual mission was tasked. This training must be proactive and embedded as a routine. However, as flying training hours shrink, it will become increasingly difficult to keep our pilots proficient across the diverse missions the C-17 brings to the fight.

The lack of comprehensive standards or steps to achieve proficiency, combined with the fiscal constraints on the Air Force, create a perfect storm surrounding flying hours and aircrew proficiency. How should the Air Force solve the "proficiency puzzle" for its mobility pilots, given the simultaneous drawdown in resources for training and apportionments for mission experience? This study focuses on the C-17 aircraft and pilot force since fiscal year 2000. Fiscal year 2000 was the last year programmed before the events on 11 September 2001 and the beginning of two major combat operations in Iraq and Afghanistan. This study begins by analyzing the specific skills and requirements needed to be a C-17 pilot. Then it explores the pilot-maturation process and methods, achievement, and measurement of proficiency. The next chapter explores the current Air Force flying-hour and readiness dilemma through historical analysis since fiscal year 2000, during peacetime and combat operations. Additionally, it discusses training technology and unique C-17 mission sets. Finally, the last chapter looks at some innovative approaches to reduce the moral hazard for Air Force leadership by increasing aircrew proficiency and transforming training opportunities across the C-17 pilot force. Efficient and effective training is critical to national defense; President Obama promised the United States will "keep our Armed Forces the best-trained, best-led, best-equipped fighting force in history."[19] The Department of Defense, USTRANSCOM, the Air Force, and the MAF in particular must uphold the President's promise and the Defense Strategic Guidance despite the trend of decreasing flying hours.

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[19] Department of Defense, *Defense Strategic Guidance*, 3.

CHAPTER 1

Pilot Training: Building Blocks for Flying

When lack of skill, currency, or knowledge becomes unacceptable, and when total competence is seen as the standard of airmanship, the cultural change will have occurred.

General John Shaud, USAF (Retired)

Since 2000, the C-17 community has experienced eight[1] Class A Safety Mishaps resulting from pilot error over the course of 1,249,581.6 flying hours.[2] Could training, proficiency, and airmanship have prevented these eight mishaps and four fatalities? The answer to this question originates with the training process for a C-17 pilot and the rigorous training regime that pilots accomplish before the first operational mission.

Initial Flight Screening

All pilots are Air Force officers first and foremost. To become an officer, pilots complete a bachelor's degree program and receive a commission through one of three commissioning sources: United States Air Force Academy, Air Force Reserve Officer Training Corps (AFROTC), or Officer Training School (OTS). Prior to commissioning, each officer undergoes medical, physical, and mental screening to determine Air Force career eligibility. This evaluation includes "objective factors such as GPA [grade point average] and AFOQT [Air Force Officer Qualifying Test] score and subjective factors such as work experience, accomplishments, character, leadership ability, and potential for future growth."[3] If eligible, based on the selection process, the candidate can then volunteer for pilot training; each commissioning source has a separate pilot-selection process. Individuals can also volunteer for pilot training from active-duty status. They must meet the same medical and physical requirements as other pilot candidates. All of

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[1] Accident Investigation Board (AIB) Reports, "United States Air Force Class A Aerospace Mishaps," United States Air Force Judge Advocate General's Corps, http://usaf.aib.law.af.mil/indexFY02.html (accessed 2 January 2013).

[2] Air Mobility Command (AMC)/A3TR, "C-17 FY00-13 Flying Hour Program," Excel Spreadsheets, (compiled 20 January 2013).

[3] Department of the Air Force, "Joining the Air Force: Officer Overview," http://www.airforce.com/joining-the-air-force/officer-overview/ (accessed 27 March 2013).

these individuals compete through the Undergraduate Flying Training (UFT) Selection Board that selects candidates for fiscally determined training requirements.[4] All four options to become a pilot are rigorous, and candidates are meticulously screened prior to entrance into initial flight screening.

After enduring the competitive process to start flight training, pilot candidates enter an Initial Flight Screening (IFS) program in Pueblo, Colorado. This program lasts 22 training days. IFS affords the Air Force an additional candidate-screening step and provides the officer motivation and preparation for Joint Specialized Undergraduate Pilot Training (JSUPT).[5] Flight screening introduces the student pilot to military ground and flight training procedures through individual instruction on the "principles and techniques used in basic flying operations."[6] Each pilot candidate receives 14 sorties including one solo flight and approximately 18 flight hours in a Diamond DA 20-C1 aircraft. The Air Force contractor for IFS, Doss Aviation, chose the Diamond DA 20-C1 for its side-by-side dual-seat, sporty, propeller configuration ideal for initial training.[7] In addition to the flying sorties, these students go through 59 hours of ground training to discuss aerodynamics, weather, officer development, ground training, and general aircraft knowledge.[8] The flight and ground-training time does not include the pre-briefing and debriefing time each individual requires in the training environment. During these 22 days, the students are indoctrinated into aircraft emergencies, Crew Resource Management (CRM), and proficiency standards. The expectation for each student is to improve through repetitive maneuvers and achieve the ability to maintain basic aircraft control through smooth and positive control inputs. The IFS syllabus details all of the maneuvers and procedures the student pilot must accomplish as well as the standard required for proficiency. This is an introduction to the objective and subjective grading

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[4] Air Force myPers, "Undergraduate Flying Training (UFT)," Air Force Personnel Center, https://gum-crm.csd.disa.mil/app/answers/detail/a_id/24525/kw/uft /p/8%2C9 (accessed 27 March 2013).
[5] Air Education and Training Command (AETC) Syllabus S-V8A-S, *Pilot Initial Flight Screening*, May 2010, 1.
[6] AETC Syllabus S=V8A-S, *Pilot Initial Flight Screening*, 1.
[7] Doss Aviation Initial Flight Screening, "The Diamond DA 20-C1," http://dossifs.com (accessed 27 March 2013).
[8] AETC Syllabus S=V8A-S, *Pilot Initial Flight Screening*, 1.

scale the Air Force utilizes to determine pilot proficiency. As an example, the standards required for accomplishing basic aircraft control and cross-check are to maintain "plus or minus 100 feet of desired altitude, plus or minus 10 KIAS [knots indicated airspeed] of desired airspeed, plus or minus 10 degrees of desired heading, maintain coordinated flight, no more than half ball off-center, [and] maintain smooth and positive control consistent with flight conditions."[9] This training establishes the building blocks of a demanding career in flying. When a pilot candidate graduates from Initial Flight Screening, the Air Force has invested 18 flying hours and 59 ground-training hours over the course of 22 days. The officer then is qualified to enter Joint Specialized Undergraduate Pilot Training (JSUPT), the next step to becoming an Air Force pilot. [10]

JSUPT – Preflight and Primary Phase

Following Initial Flight Screening a pilot candidate is prepared to undertake the rigors of JSUPT. The Preflight Phase of pilot training begins when the student arrives at the training base and concludes at the start of the primary phase when the officer transitions to flying operations. During the preflight phase, the pilot candidate spends 212 hours in academic classes, studying topics from physiology and life support to weather and aircraft systems.[11] The first 31 training days build on the foundation from IFS and prepare the students for flying an advanced aircraft during the primary phase.

The Primary Phase begins when the students move to flying operations and begin their training in the T-6A Texan II program for the Joint Primary Pilot Training (JPPT) program.[12] The T-6A Texan is a dual seat, stepped-tandem, single engine, turbo-prop, training aircraft designed for Air Force and Navy student pilots.[13] This phase of training

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[9] AETC Syllabus S=V8A-S, *Pilot Initial Flight Screening*, 10.

[10] This study focused on JSUPT and not Euro-NATO Joint Training (ENJJPT) at Sheppard Air Force Base, Texas. ENJJPT's pilot training pipeline is similar, but the training syllabus contains differences not investigated by this research.

[11] Air Education and Training Command (AETC) Syllabus P-V4A-J, *T-6A Joint Primary Pilot Training*, September 2012, 1.

[12] AETC Syllabus P-V4A-J, *T-6A Joint Primary Pilot Training*, 1.

[13] Department of the Air Force, "T-6A Texan II," Fact Sheet, 24 November 2010, http://www.af.mil/information/factsheets/factsheet.asp?id=124 (accessed 27 March 2012). "Stepped-tandem seating in the single cockpit places one crewmember in front of

requires the students to operate an advanced aircraft in a wide variety of maneuvers designed to increase flight skills and proficiency and to determine pilot aptitude for the advanced phase of pilot training. In addition to flight and ground training, the primary phase utilizes another medium,[14] Aircrew Training Devices (ATD) or simulators, "a complement of simulator training devices used in this program consisting of the UTD [Unit Training Device], IFT [Instrument Flight Trainer], and OFT [Operational Flight Trainer]."[15] Students accomplish different aspects of their training in these devices. In the Unit Training Device, a student can accomplish procedures and instrument flying without visual support, and each accomplishes six sorties for nearly eight hours in the UTD. The preflight phase also utilizes the UTD for two of these six sorties for a total of four hours, as academic events. The Instrument Flight Trainer exploits more technology and allows a "narrow field of view visual system to support instrument flying."[16] Through 18 sorties and almost 24 hours of flight time, the student pilots receive realistic training and practice opportunities in the Instrument Flight Trainer. The final device, Operational Flight Trainer is the most advanced technology. It provides a display that supports instrument and visual flight, and the students complete 11 sorties for a total of 14 hours. During this accumulation of 35 sorties, over 45 hours the students and instructors use the Aircrew Training Devices to supplement flying hours and rehearse emergency and normal procedures, continually working to gain proficiency in the aircraft. The Primary Phase introduces the utility of technologies that augment aircraft sorties in the flying environment; both are critical to a pilot's future. Training devices and aircraft sorties comprise many pieces of the proficiency puzzle.

Students practice maneuvers in the different levels of simulators systematically to build proficiency on a procedure. The intent of each sortie in a device is to increase the

the other, with the student and instructor positions being interchangeable. A pilot may also fly the aircraft alone from the front seat."

[14] Air Education and Training Command Instruction (AETCI) 36-2205 Volume 1, *Formal Flying Training Administration and Management*, 29 May 2009 Certified Current, 17 October 2011, 14. "Medium—Media include aircraft, ground training, computer-assisted instruction, instrument flight trainer, mission training center, networked training center-Luke, operational flight trainers, unit training devices, and weapon system trainers."
[15] AETC Syllabus P-V4A-J, *T-6A Joint Primary Pilot Training*, 73.
[16] AETC Syllabus P-V4A-J, *T-6A Joint Primary Pilot Training*, 72.

skills of the pilot to translate to the aircraft. The Primary Phase operates under a crawl, walk, and run approach to build a pilot through three phases: contact, instrument, and formation. The contact phase consists of half of the total sorties during primary phase and almost half of all total hours. The maneuvers practiced during this phase range from the fundamental skills to solo an aircraft to advanced aerobatic maneuvers. After demonstrating proficiency in the basics of flying, the student moves from the contact phase to instruments. The instrument phase tests the pilot's precision in flying through degraded visual environments by use of instruments, for example an artificial horizon indicator that displays the attitude of the aircraft. The training devices employed during this phase are extremely effective simulating instrument flight. During this phase, the student has 10 flights for almost 15 hours. The final phase of Primary is formation. The formation phase challenges the students to utilize all the flying skills and situational awareness they have developed and put it into practice over the course of 15 sorties and 21 hours. Table 1 illustrates the sorties and hours required in each phase of the primary training by devices and flights.

After the completion of Preflight and Primary Phase, approximately 28 calendar weeks, a student pilot has accomplished 212 hours of academic training, more than 20 hours of ground training, 46 hours over the course of 35 sorties in training devices, and approximately 80 hours in the T-6A Texan.[17] At the end of the 28 weeks the student's demonstrated confidence, knowledge, airmanship, and flying skills warrant advancement to more specialized training. The student pilot is prepared for the third phase of Joint Specialized Undergraduate Pilot Training, the Advanced Phase.

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[17] AETC Syllabus P-V4A-J, *T-6A Joint Primary Pilot Training*, 1.

Table 1: Primary Phase Device / Flying Training – Sorties / Hours

Category	Dual UTD		Dual IFT		Dual OFT		Dual Aircraft		Solo Aircraft		EPD
	Sorties	Hours	Sorties	Hours	Sorties	Hours	Sorties	Hours	Sorties	Hours	
Academics [1]	2	2.0									
Basic	3	3.9	1	1.3							
Contact			1	1.3	7	9.1	23	29.8	4	4.5	
Midphase Check							1	1.3			
Final Contact Check							1	1.4			
Instruments	3	3.9	14	18.2	1	1.3	9	13.5			
Instrument Check							1	1.4			
IFR/VFR Navigation			2	2.8	1	1.3	6	9.6			
Low-Level					1	1.3	2	2.8			
Formation					1	1.3	8	11.2	1	1.3	
Advanced Formation							6	8.4			
Formation Check							1	1.4			
Totals	6	7.8	18	23.6	11	14.3	58	80.8	5	5.8	1.02*

Notes

1. Dual UTD sorties and hours are accounted for in Systems 1 and 2 academics.

2. No time is identified for briefing, debriefing, or ATD setup.

3. *Events per Day (EPD) assumes 2 academic events in UTD and 6 normal simulators are accomplished in the Preflight Phase.

4. **Two of the I22XX instrument simulators are flown in the OFT to accomplish circling training requirements.|

Source: Reprinted from AETC Syllabus P-V4A-J, T-6A Joint Primary Pilot Training, September 2012, 2.

JSUPT – Advanced Phase

Following the Preflight and Primary Phases, the students choose one of three tracks for their next phase of pilot training: airlift/tanker, helicopter, and bomber/fighter. The basis for a student's track selection from the primary phase is a result of the Air Force's needs, availability, and the student's desires.[18] A C-17 pilot will follow the airlift/tanker track and conduct training in the T-1A Jayhawk. The T-1A is a medium-range, twin engine…military version of the Beech 400.[19] It operates with two students and an instructor to facilitate a crew-focused mentality and provides a platform for flying-skills training with a crew-resource-management (CRM) concentration. At the beginning of the advanced phase, the students attend 142 hours of academics, focusing on

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[18] AETCI 36-2205 Volume 4, *Formal Flying Training Administration and Management -- T1A, T6A, T38C, and TH1H*, 42.

[19] Department of the Air Force, "T-1A Jayhawk," Fact Sheet, 28 January 2011, http://www.af.mil/information/factsheets/factsheet.asp?id=123 (accessed 27 March 2013)

the transition to a new aircraft and strengthening basic flying knowledge and operations. Similar to the T-6A, the T-1A utilizes technology through simulators to hone flying maneuvers and employs a part-task trainer for some procedural training and demonstration. The simulator accounts for the majority of the complementary training during the three main phases of Advanced training. T-1A training begins with a transition phase, continues with navigation, and finishes with air-mobility fundamentals.

In the transition phase, the student learns normal operating procedures, basics of flying, and additional instrument-flight essentials. Over the course of 10 simulators and 13 flights, students gain proficiency through repetition and concentrated instruction. After a successful Transition Flight Check, students progress to the navigation phase.[20] It contains the predominant number of activities and is the pivotal learning segment of the T-1A curriculum. Through only 18 flights and eight simulators, the students must demonstrate proficiency in advanced instrument flying and navigation, a critical requirement for future mobility pilots. Following over 30 hours of aircraft flight time and 20 hours in the simulator, the student flies a Navigation Flight Check to evaluate proficiency. With the completion of the navigation phase, the training focus shifts to Air Mobility Fundamentals: copilot flying and monitoring duties,[21] formation flying, and simulated air refueling and air drop.[22] During this phase of training, the students complete three simulator sorties and 10 flights before a flight evaluation. The final flight in the T-1A syllabus and a mobility pilot's JSUPT experience is the Air Mobility Fundamentals flight check, which will confirm "satisfactory proficiency level in a cross

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[20] Air Education and Training Command (AETC) Syllabus P-V4A-G, *T-1A Joint Specialized Undergraduate Pilot (JSUPT) Training,* July 2012, 11-22, 30-31. Flight Check – "demonstrate the required proficiency level on a cross section of transition maneuvers." The parameters for grading and determining the proficiency level for each maneuver are directed in chapter 2, section D of the T-1A JSUPT, AETC Syllabus P-V4A-G.

[21] AETC Syllabus P-V4A-G, *T-1A Joint Specialized Undergraduate Pilot Training*, 36. The preponderance of copilots' flight time is in the right seat of a mobility aircraft and the Air Mobility Fundamentals phase of the T-1A syllabus emphasizes flying and "monitoring duties from the right seat."

[22] Air Force Manual (AFMAN) 11-247, *T-1A Flying Fundamentals*, 10 April 2013, 92. "The main objective of an airdrop mission is to deliver cargo and troops to the drop zone (DZ) safely, accurately, and on time."

section of formation airdrop [and] air refueling procedures."[23] Table 2, on the next page, shows the simulator and flight portion of training for each phase. After successful completion of the final flight check, each T-1A student has completed 120 training days encompassing more than 142 hours of academics, 11 hours of ground training, 21 simulator sorties for 53 hours, and 42 flights for over 75 hours.

Table 2: T-1A Advanced Phase Simulator / Aircraft Training – Events / Hours

10. Simulator / Aircraft Resources	Simulator		Aircraft	
Category	Events	Hours	Events	Hours
Emergency Procedures	3	7.8		
Transition	7	17.2	12	19.2
Transition Check			1	1.6
Copilot			1	1.7
Navigation	8	20.8	16	30.4
Navigation Check			1	3.5
Air Mobility Fundamentals				
Formation	1	2.6	4	6.0
Airdrop / Air Refueling	2	5.2	6	12.0
Air Mobility Fundamentals Check			1	2.0
Total	21	53.6	42	76.4

Note: Simulator training includes 1 event (1.6 hours) in the flight mock-up trainer (FMT) and 20 events (52.0 hours) in the T96 simulator.

Source: Reprinted from AETC Syllabus P-V4A-G, T-1A Joint Specialized Undergraduate Pilot Training, July 2012, 2.

During the Preflight, Primary, and Advanced Phase of Joint Specialized Undergraduate Pilot Training, students compete for merit ranking by virtue of their scores on all the training events. The constant competition between the students breeds camaraderie and motivation to improve; competition is integral to the pilot-training process. During the last month of JSUPT a student pilot's assignment desires, skills, and potential are balanced with the needs of the Air Force to determine the major weapon system (MWS) and basing assignment.[24] In this case, after receiving a C-17 assignment and successfully completing JSUPT, the officer obtains the Air Force Aeronautical Rating of Pilot, in accordance with Title 10, United States Code 8691.[25] Over the course

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[23] AETC Syllabus P-V4A-G, *T-1A Joint Specialized Undergraduate Pilot Training*, 36.
[24] AETCI 36-2205 Volume 4, *Formal Flying Training Administration and Management - - T1A, T6A, T38C, and TH1H*, 50.
[25] Air Force Instruction (AFI) 11-402, *Aviation and Parachutist Service, Aeronautical Ratings and Aviation Badges*, 13 December 2010, 18.

of 263 training days, new pilots from the airlift/tanker track accumulate more than 280 flight hours during 175 sorties in an aircraft or simulator and 427 hours of ground and academic training. According to Air Force Instruction 65-503, Table A34-2 Representative Officer Aircrew Training Costs Variable and Fixed, the Air Force invests $767,494 per pilot graduate in Joint Specialized Undergraduate Pilot Training.[26] This investment includes Initial Flight Screening, Preflight, Primary and T-1A Advanced phase of JSUPT. Table 3 explores the specifics for each phase of IFS and JSUPT, and the investment the Air Force makes in pilot proficiency across almost 18 months of training. After graduation from Joint Specialized Undergraduate Pilot training the pilot reports to a specific major weapon system flying training unit (FTU).

Table 3: Initial Flight Screening and Joint Specialized Undergraduate Pilot Training Phase Totals and Investment Per Graduate[27]

Phase of Training	Training Days	Ground Training Hours	Academic Training Hours	Simulator		Aircraft		Total Sorties	Total Hours	Investment Cost (FY 13)
				Sorties	Hours	Sorties	Hours			
IFS[1]	22	15.5	25.5	0	0.0	14	18.0	14.0	59.0	$18,140
Preflight / Primary[2]	121	20.5	212.3	35	45.7	63	86.6	98	365.1	$348,508
Advanced	120	11.6	142.4	21	53.6	42	76.4	63	284.0	$400,846
Total	**263**	**47.6**	**380.2**	**56**	**99.3**	**119**	**181.0**	**175.0**	**708.1**	**$767,494**

Initial Flight Screening (IFS) and Joint Specialized Undergraduate Pilot Training (JSUPT) Phase Totals and Investment Per Graduate (Fiscal Year 2013 Estimates)

1. IFS Phase has 5.0 hours of Indoctrination, for the purpose of this study it was added to Ground Training and 13.0 hours of Officer Development was added to Academic Training.
2. Preflight has 31 Training Day and Primary consists of 90 training days for approximately 28 calendar weeks.

Source: Adapted from multiples sources, see Bibliography for AETC Syllabus P-V4A-G, AETC Syllabus P-V4A-J, AETC Syllabus S-V8A-S, and "A34-2 Representative Officer Aircrew Training Costs Variable and Fixed 8 January 2013."

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[26] Department of the Air Force, "A34-2 Representative Officer Aircrew Training Costs Variable and Fixed 8 January 2013," Air Force Portal, Financial Management, AFI 65-503, Cost Factors: Factors Tables, https://www.my.af.mil/gcssaf/USAF/ep/content View.do?contentType=EDITORIAL&contentId=c6925EC176FB40FB5E044080020E32 9A9&channelPageId=s6925EC1350500FB5E044080020E329A9&programId=t6925EC2 D4BC30FB5E044080020E329A9 (accessed 27 March 2013). The IFS cost calculation is based on 1,200 students.

[27] Table 3 was adapted from multiples sources, see Bibliography for AETC Syllabus P-V4A-G, AETC Syllabus P-V4A-J, AETC Syllabus S-V8A-S, and "A34-2 Representative Officer Aircrew Training Costs Variable and Fixed 8 January 2013."

C-17 Pilot Initial Qualification

Following JSUPT graduation pilots with C-17 assignments, report for training to Altus Air Force Base, Oklahoma. "The C-17 Globemaster III is the newest, most flexible cargo aircraft to enter the airlift force."[28] Its flexibility provides the nation troop transport, airdrop capability, outsized-cargo delivery to austere environments, and critical aeromedical evacuation support. The aircraft can transform to the required mission configuration with on-board equipment, but the aircrew must have specific training to accomplish many of the C-17's missions. One of the key building blocks to the crew force begins with C-17 pilot initial qualification.[29]

The C-17 pilot initial qualification course consists of 68 training days and over 357 total hours of training. With one of the most advanced aircraft in the Air Force's airlift fleet, training sustains a technological focus. The syllabus begins with a combination of computer-based training supplemented with instructor-assisted training sessions. Throughout the course, technological augmentation increases with multiple training devices. Some of the additional devises are Cockpit Systems Simulator (CSS), Core Integrated Processor (CIP) Trainer, Reconfigurable Desktop Simulator (RDS), Part Task Trainer (PTT), and the Weapons System Trainer (WST).[30] Similar to the training process a pilot followed in the initial flight screening and JSUPT, the C-17 syllabus utilizes repetition and a building-block approach to training through diverse mediums to build flying proficiency. Table 4 illustrates these training blocks of the C-17 pilot initial qualification course and provides an overview of the hours and sorties spent training. The complexity of the C-17 necessitates an intense academic foundation of over 157 hours. During the academic portion of training, the pilots require 35 hours of introductory training, over 34 hours of aircraft-systems knowledge, 36 hours of flight-

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[28] Department of the Air Force, "C-17 Globemaster III," Fact Sheet, 29 December 2011, http://www.af.mil/information/factsheets/factsheet.asp?id=86 (accessed 18 March 2013).
[29] Air Force Instruction (AFI) 11-2C-17 Volume 3, *C-17 Operations Procedures*, 16 November 2011, 23. Table 3.1, Aircrew Complement, defines a basic C-17 crew as one aircraft commander, one pilot or copilot, and one loadmaster. Specific missions will dictate different crew compliments: augmented, basic plus one, or specialized mission requirements.
[30] Air Education and Training Command (AETC) Syllabus C-17PIQ, *C-17 Pilot Initial Qualification (PIQ) (FMS Included)*, December 2011, 1.

procedures training, and 46 hours of flight planning.[31] With a strong academic foundation, pilots progress to simulator training and participate in instructor-facilitated training for every sortie in a training device, resulting in over 52 hours of briefings to prepare the pilot for maximum device effectiveness and realistic, transferable training.[32] According to the syllabus, in the fifteenth simulator the new pilots fly a qualification evaluation for general proficiency and instrument training.[33] Following the evaluation, pilots continue with the syllabus; and after 59 training days, 16 sorties and 38 hours in the Cockpit System Simulator, and 27 sorties and 78 hours in the Weapon System Trainer, the initial qualification pilot is ready for the flying-training phase.

Table 4: C-17 Pilot Initial Qualification (PIQ) Total Training Data

Emphasis Area	Approx Tng Days	Acad Hours	Procedural Trainers³			Simulator			Flight			Total Hrs
			No. Msns	Supp Hrs¹	Msn Hrs	No. Msns	Supp Hrs¹	Msn Hrs	No. Msns²	Supp Hrs¹	Msn Hrs²	
Academics³	22	135.9	12		21.5							157.4
CSS	6					16	8.0	38.0				46.0
Schedule Adjust⁴	9											—
WST⁵	27					27	44.3	78.0				122.3
FLT⁶	4								4	13.4	18.0	31.4
Total Training Data	68	135.9	12		21.5	43	52.3	116.0	4	13.4	18.0	357.1

Notes:

1. Support hours include briefing, preflight, debriefing, and mission planning.

2. Total number of missions and mission hours includes observation flight and the mission qualification evaluation.

3. Academic procedural trainers consist of the following: 10 CIP trainers (16.0 hrs), one static aircraft (STAT) trainer (2.0 hrs/.5 hrs IBT), TAWS on RDS (1.5 hrs/.5 hrs IBT), and refuel/defuel training (PTT) at the Cargo Compartment Trainer (1.0 hrs).

4. Days included in the course flow to accommodate crew rest requirements, flight cancellations for weather or maintenance, and events required for additional student training.

5. There are 26 WST training missions and 1 CRM activity in the Weapon System Trainer. WST 15 is the Qualification/Instrument Evaluation.

6. Flight Training — includes an observation flight, 1 qualification training sortie, and 1 NVG training sortie. FLT 03 is the USAF Evaluation.

7. FMS totals may vary slightly based upon non-disclosure items (see Chapter 5, Section D — International Training Syllabus Flow).

Source: Reprinted from AETC Syllabus C-17PIQ, C-17 PIQ (FMS Included), December 2011, 2.

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[31] AETC Syllabus C-17PIQ, *C-17 PIQ (FMS Included)*, 3, 9-13.
[32] Training occurs in two devices or mediums during the simulator phase, Cockpit System Simulator (CSS) and Weapon System Trainer (WST).
[33] Air Force Instruction (AFI) 11-2C-17 Volume 2, C-*17 Aircrew Evaluation Criteria*, 19 April 2005, 11. "2.2 Instrument Evaluations (Initial, Periodic and Requalification). The C-17 instrument evaluation will normally be conducted in the WST in conjunction with the qualification evaluation. Include all areas under GENERAL and INSTRUMENT."

The flying-training phase and simulator phase do have an intentional overlap on training day 22. The first flight is an observation flight scheduled after 14 Cockpit System Simulators, but prior to the first Weapon System Trainer sortie. In approximately four hours, the student gains insight into crew-resource management, mission timing, and aircraft flight characteristics, providing a reference base to the aircraft that is crucial to realistic simulator training. After the observation flight, students complete the simulator phase and return to flying training for two instructional flights and the final initial-qualification evaluation flight.[34] All three flights consist of mission planning the day prior to the flight, a four-hour pre-brief and a five-hour flight.[35] Flight number one, day tactical proficiency sortie, practices the basic aircraft maneuvers performed in previous simulator sorties and accomplishes as many repetitions permitted within the time constraints. The next flying sortie is for Night-Vision-Goggle training and certification. Following this sortie, initial qualification pilots fly an evaluation sortie. This flight evaluates the pilot on basic aircraft maneuvers accomplished on flight one according to the grading criteria directed by Air Force Instruction.[36] The evaluation flight completes the pilot initial qualification course and an Air Force Form 8, *Certificate of Air Crew Qualification*.[37] The Form 8 represents the culmination of four aircraft sorties, 18 hours of flight time, 116 simulator hours over 43 sorties, and more than 157 hours of academics. Table 5 exhibits the time and resource investment to training a C-17 pilot. In approximately 18 to 24 months of training, from Initial Flight Screening through the C-17 Pilot Initial Qualification course, and after a $1,057,979 investment, the pilot is trained and ready for assignment to an operational C-17 unit. The problem before us now is the retention of airmanship and the seasoning of judgment that amounts to proficiency.

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[34] Air Force Instruction (AFI) 11-202 Volume 2, *Aircrew Standardization/Evaluation Program*, 13 September 2010, 64. "Qualification Evaluation—Qualifies and aircrew member to perform the duties of a particular crew position in the specified aircraft."
[35] During mission planning and the pre-brief, instructors focus on general knowledge and flight procedures.
[36] AFI 11-2C-17 Volume 2, C-*17 Aircrew Evaluation Criteria*, 15-24. Chapter 2, section 2.9, provides the pilot evaluation grading criteria.
[37] AFI 11-202 Volume 2, *Aircrew Standardization/Evaluation Program*, 34. "The AF Form 8/8a is the source document used to record and verify the qualification of an aircrew member."

Table 5: Initial Flight Screening and Joint Specialized Undergraduate Pilot Training, and C-17 Pilot Initial Qualification Phase Totals and Investment Per Graduate

Phase of Training	Training Days	Ground Training Hours	Academic Training Hours	Simulator		Aircraft		Total Sorties	Total Hours	Investment Cost (FY 13)
				Sorties	Hours	Sorties	Hours			
IFS[1]	22	15.5	25.5	0	0.0	14	18.0	14	59.0	$18,140
Preflight / Primary[2]	121	20.5	212.3	35	45.7	63	86.6	98	365.1	$348,508
Advanced	120	11.6	142.4	21	53.6	42	76.4	63	284.0	$400,846
C-17 PIQ[3]	68	65.7	157.4	43	116.0	4	18.0	47	357.1	$308,625
Total	**331**	**113.3**	**537.6**	**99**	**215.3**	**123**	**199.0**	**222**	**1065.2**	**$1,076,119**

Initial Flight Screening (IFS), Joint Specialized Undergraduate Pilot Training (JSUPT), and C-17 Pilot Initial Qualification (PIQ) Phase Totals and Investment Per Graduate (Fiscal Year 2013 Estimates)

1. IFS Phase has 5.0 hours of Indoctrination, for the purpose of this study it was added to Ground Training and 13.0 hours of Officer Development was added to Academic Training.
2. Preflight has 31 Training Day and Primary consists of 90 training days for approximately 28 calendar weeks.
3. C-17 Ground Training Hours includes support hours (briefing, preflight, debriefing, and mission planning) from C-17 PIQ syllabus. Academic Training hours include C-17 Procedural Trainer's hours

Source: Adapted from multiple sources, see bibliography for AETC Syllabus P-V4A-G, AETC Syllabus P-V4A-J, AETC Syllabus S-V8A-S, AETC Syllabus C-17PIQ, and "A34-2 Representative Officer Aircrew Training Costs Variable and Fixed."

C-17 Operations and Career Path

After completing pilot initial qualification training at the flying training unit, Altus Air Force Base, a new C-17 pilot reports to an operational base and begins mission qualification training (MQT). [38] This training contains the minimum ground and flying training events Air Mobility Command and local instructions required to produce a mission-ready pilot.[39] Each operational unit directs a tailored mission-ready program that encompasses all requirements. The 60th Operations Group C-17 Pilot Upgrade Process (PUP) training guide leads a pilot step-by-step through every training process from day one of in-processing to the last day of instructor pilot upgrade. [40] This study concentrates

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[38] Active duty operational bases in Air Mobility Command include: Joint Base Charleston, South Carolina; Dover Air Force Base, Delaware; Joint Base McGuire-Dix-Lakehurst, New Jersey; Travis Air Force Base, California; and Joint Base Lewis-McChord, Washington. Pacific Air Forces also has operational C-17 units at Joint Base Pearl Harbor-Hickam, Hawaii and Joint Base Elmendorf-Richardson, Alaska.
[39] Air Force Instruction (AFI) 11-2C-17 Volume 1, C-*17 Aircrew Training*, 1 June 2012, 24.
[40] This guide was chosen based on an Air Mobility Command's 25 January thru 1 February 2013 evaluation (ASEV - Aircrew Standardization/Evaluation Visit) of Travis Air Force Base. Travis' training programs achieved an excellent rating.

on the steps from in-processing to mission-ready certification, demonstrating the squadron's investment.

The 60th Operations Group process starts with ground training and ensures full compliance with Air Force Instruction, which directs the initial-qualification ground-training table, and the mission-certification ground-training table (see appendix A). The initial-qualification table contains events accomplished at the flying-training unit in accordance with the pilot-initial-qualification syllabus, and additionally, it requires six training events for completion at the operational unit. Finally, the initial-qualification table requires each pilot to attend the Combat Survival Evasion Resistance and Escape (SERE) Program and Water Survival Training. The Air Force invests $9,225 for SERE and $7,226 for water survival per graduate.[41] The mission-certification ground-training table focusses on ground training for operational missions and provides the new pilot with local survival tactics and guidance. In accordance with the 60th Operations Group guidance, after accomplishing the required events in these training tables, the pilot begins the local-flying portion of mission-qualification training.

At a minimum, the new pilot must accomplish a local-orientation/mission-ready flight to obtain local familiarization and C-17 procedures training. The AFI provides flexibility for a simulator flight centered on the unit's mission, but this is not standard practice, and the pilot still requires a local-orientation flight. [42] The 60th Operations Group provides approximately four hours of mission planning with an instructor pilot and five hours of training on the local flight. During the preparation and execution of this local flight, an instructor pilot accomplishes seven integral objectives. Through these seven objectives: pre-mission planning, flight-planning locations, local-operating policies and procedures, squadron local-mission procedures and sequence, operational risk management (ORM), taxi training, and finally, observe and perform local-flying procedures; the new pilot ensures completion of all Air Force Instruction requirements and provides a solid foundation for the C-17 operational squadron flight standards and

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[41] Air Education and Training Command (AETC) Financial Analysis Division, Training Branch, e-mail correspondence, 3 April 2013.
[42] AFI 11-2C-17 Volume 1, *C-17 Aircrew Training*, 25-26.

procedures.[43] Following the local flight and completion of all ground-training events, the new pilot is prepared to fly outside the continental United States on an initial overseas mission.[44] After the completion of one overseas flight, the trainee is a qualified pilot (FP) and ready for C-17 operations. This upgrade process can take a maximum of 90 calendar days, without waivers to training time, and results in a mission-qualified pilot.

Table 6: Initial Flight Screening thru C-17 Pilot Mission Ready Qualification (C-17 FP) Phase Totals and Investment Per Graduate

Initial Flight Screening (IFS) thru C-17 Pilot Mission Ready Qualification (C-17 FP) Phase Totals and Investment Per Graduate (Fiscal Year 2013 Estimates)										
Phase of Training	Training Days[3]	Ground Training Hours[4]	Academic Training Hours	Simulator		Aircraft		Total Sorties	Total Hours	Investment Cost (FY 13)
				Sorties	Hours	Sorties	Hours			
IFS + SUPT	263	47.6	380.2	56	99.3	119	181.0	175	708.1	$767,494
C-17 PIQ[1]	68	65.7	157.4	43	116.0	4	18.0	47	357.1	$308,625
C-17 FP[2]	90	20.5	4.0	0	0.0	2	12.0	2	36.5	$202,237
Total	**421**	**133.8**	**541.6**	**99**	**215.3**	**125**	**211.0**	**224**	**1101.7**	**$1,278,356**

1. C-17 PIQ Ground Training Hours includes support hours (briefing, preflight, debriefing, and mission planning) from C-17 PIQ syllabus. Academic Training hours include C-17 Procedural Trainer's hours.

2. C-17 FP investment cost includes: Combat SERE ($9,225), Water Survival Training ($7,226), C-17 training hours according to AMC/A3TR ($17,896 per training hour) and C-17 mission hours (1 overseas leg of 7 hours - average time from U.S. east coast to Europe or U.S. west coast to Pacific) according to AFI 65-503, A4-1 Logistics Cost Factor Table ($13,758 per mission hour)

3. C-17 FP training days are 90 calendar days, according to AFI 11-2C-17 Vol 1, Table 1.2 In-Unit Training Time Limitations.

4. C-17 FP Ground Training Hours include estimates from 60th Operations Group Ground Training schedule and the AFI 11-2C-17 Vol 1 Table 2.1 and 3.1 ground training requirements for in-unit pilot initial qualification mission ready training.

Source: Adapted from multiple sources, see bibliography for AFI 11-2C-17 Volume 1 and "A4-1 Logistics Cost Factor Table 25 October 2012."

Table 6 illustrates the overall investment to train a qualified pilot from Initial Flight Screening thru operationally mission-ready C-17 pilot (FP). Over the course of almost two years (IFS, JSUTP, PIQ and local training) and an investment of approximately $1.3 million, a C-17 copilot is mission-ready. The Air Force has built a strong foundation for the pilot's development, but maintaining and enhancing proficiency requires significant time and fiscal investment. Training is never complete; mission-ready certification is the beginning of more upgrade training, seasoning, and the continual struggle to maintain proficiency. The Air Force must be committed to maintain this

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[43] 60th Operations Group (OG), "C-17 Pilot Upgrade Process Training Guide" (U), 22 August 2012, Attachment 2, 30-31. (FOUO)

[44] 60th OG, "C-17 Pilot Upgrade Process Training Guide,"9. "OCONUS Dollar Ride…this lesson provides the student initial mission duty familiarization. During this lesson, the student will participate as a non-primary crewmember on an overseas mission."

critical investment in "Global Reach." The next chapter focuses on a new pilot's ongoing training requirements to build and maintain airmanship, the ultimate goal of the "proficiency puzzle."

CHAPTER 2
Airmanship: Integral to Proficiency

There is no such thing as a natural-born pilot. Whatever my aptitudes or talents, becoming a proficient pilot was hard work, really a lifetime's learning experience. For the best pilots, flying is an obsession, the one thing in life they must do continually. The best pilots fly more than the others; that's why they're the best. Experience is everything. The eagerness to learn how and why every piece of equipment works is everything. And luck is everything, too.

Brigadier General Charles E. "Chuck" Yeager

The hard work to maintain proficiency starts the first day of initial flight screening and continues until a pilot's final flight, but what is proficiency? Training conversations consistently misuse proficiency, because of its multiple definitions and interpretations. Proficiency is "the quality or state of being proficient" and proficient is "well advanced in an art, occupation, or branch of knowledge."[1] Flying is an art form that embraces technical, cognitive, and physiological elements. Therefore, a definition for proficiency is bound to be elusive and results in the "proficiency puzzle."

The Air Force defines proficiency as "a measure of how well a task is completed. Aircrew members are considered proficient when they can perform tasks at the minimum acceptable levels of speed, accuracy, and safety."[2] In accordance with this definition, each mission area has established parameters to meet and maintain Air Force standards. Standardization and evaluation pilots evaluate the standards "to ensure an accurate assessment of the proficiency and capabilities of aircrews."[3] For the C-17, these standards are divided into different mission areas, and the evaluator utilizes a tiered grading criterion for each area and subarea. These tiers consist of Q, Q-, and U. Flight examiners are directed to evaluate proficiency as follows:

A "Q" is the desired level of performance. The examinee demonstrated a satisfactory knowledge of all required information, preformed aircrew duties within the prescribed tolerances, and accomplished the assigned mission. A "Q-" indicates the examinee is qualified to perform the assigned area tasks, but requires debriefing or additional training as

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[1] *Merriam-Webster's Collegiate Dictionary*, 11th ed., s.v. "proficiency, proficient."
[2] Air Force Instruction 11-202 Volume 1, *Aircrew Training*, 22 November 2010, 24.
[3] Air Force Instruction (AFI) 11-2C-17 Volume 2, C-*17 Aircrew Evaluation Criteria*, 19 April 2005, 4.

determined by the flight examiner. Deviations from established standards must not exceed the prescribed Q- tolerances or jeopardize flight safety. Assign a "U" area grade for any breach of flight discipline, performance outside allowable parameters or deviations from prescribed procedures/tolerances that adversely affected mission accomplishment or compromised flight safety.[4]

Each individual area and subarea contains specific level descriptions for Q, Q-, and U for evaluation. This provides an objective baseline for analysis. Evaluators use this baseline, combined with subjective scrutiny, to evaluate proficiency.

The broad definitions and standards dictated by Air Force instructions attempt to provide an objective formula for proficiency, but proficiency is a subjective measurement of piloting skills; an integral element is personal responsibility. Flying performance directly results from personal preparation and a pilot's honest opinion of individual proficiency. Each pilot must acknowledge flying weaknesses, similar to a professional athlete. Pilots and athletes engage in a profession where perishable skills make daily practice essential to strengthen weaknesses and, more importantly, impede decay of skills. Babe Ruth, one of the greatest baseball players in history, said, "A part of control is learning to correct your weaknesses. The person doesn't live who was born with everything. Sometimes he has one weak point; generally, he has several. The first thing is to correct them. You know the old saying about a chain being only as strong as its weakest link. The same can be said in the chain of skills a man forges."[5] Pilots' flying skills are only as strong as the individual's weakest area and subarea of flying. Pilots must focus on proficiency across all disciplines and maintain, as Major General Sam Cox states, a "level of capability to execute assigned aviation tasks safely and effectively without direct supervision or intervention."[6] A pilot must achieve this level of capability,

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[4] AFI 11-2C-17 Volume 2, *C-17 Aircrew Evaluation Criteria*, 8.

[5] Howard E. Ferguson, *The Edge: The Guide to fulfilling Dreams, Maximizing Success and Enjoying a Lifetime of Achievement* (Cleveland, OH: Getting the Edge Company, 1990), 3-24.

[6] Maj Gen Samuel D. Cox (Director of Operations and Plans, US Transportation Command, Scott Air Force Base, IL), in discussion with the author, 3 Feb 2013. This is Maj Gen Cox's definition of proficiency. He has flown over 4,600 hours in mobility aircraft (C-17, C-141, and C-5) and trainers (T-37 and T-38).

but should strive for perfection. Perfection is unattainable, but proficiency is achieved with the pilot focused continually on knowledge, maneuver, and mission perfection.

Proficiency is the personal responsibility of the individual; and, for the Air Force, the unit commander is accountable for the squadron's proficiency. The Air Force Instruction, "establishes the minimum flying and related ground training requirements to maintain currency. The unit commander will ensure each crewmember receives sufficient continuation training to maintain individual proficiency."[7] Continuation-training currency does not equal proficiency; it is an objective tool used to gain a skills baseline for proficiency. [8] Furthermore, continuation-training currency is a metric for major-command leadership and wing leadership to analyze training progression, but it is not how the operations group should determine proficiency. It is difficult to execute this subjective investigation of each crewmember, but it is the commander's obligation. What exactly is the commander attempting to determine for each crewmember? Terminology is critical and confusion results from a broadened definition of individual proficiency. The commander must determine proficiency. Therefore, what pieces are required to construct and integrate in order to solve a pilot's "proficiency puzzle."

Puzzle Pieces

The puzzle pieces needed to achieve proficiency are similar to Dr. Tony Kern's airmanship model. Kern created the airmanship model to illustrate the requirements of a modern airman, through historical research into manned flight and the technological future.[9] Kern defines airmanship as, "the consistent use of good judgment and well-developed skills to accomplish flight objectives. This consistency is founded on a cornerstone of uncompromising flight discipline and developed through systematic skill

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[7] Air Force Instruction (AFI) 11-2C-17 Volume 1, C-*17 Aircrew Training*, 1 June 2012, 27.
[8] AFI 11-2C-17 Volume 1, *C-17 Aircrew Training*, 121. "Continuation Training – Ground and flight training events necessary to maintain mission-ready or basic qualification status."
[9] Tony Kern, *Redefining Airmanship,* (New York, NY: McGraw-Hill, 1997), 21. Dr. Tony Kern is an Air Force retired Lt Col and command pilot in the B-1 and KC-135. Dr. Kern is currently the CEO at Convergent Performance, LLC, specializing in human factors programs for high-risk industries.

acquisition and proficiency. A high state of situational awareness completes the airmanship picture and is obtained through knowledge of one's self, aircraft, team, environment, and risk."[10] Kern's definition of airmanship is how the Air Force defines proficiency. The pieces he provides in his model provide a balance of holistic and focused training to develop the required aviation prowess for safe operations. Kern's model establishes building blocks for aircrew training starting with bedrock principles, then pillars of knowledge, leading to capstone outcomes.[11] Figure 2 is an adaptation of Kern's model to clarify the construction of the "proficiency puzzle." The first step in constructing a puzzle is finding the foundation pieces that shape the puzzle. These pieces for proficiency contain three critical elements: flight discipline, skill, and currency.

Figure 2: The Proficiency Puzzle – An adaptation of Dr. Kern's Airmanship Model

Source: Adapted from Tony Kern, Redefining Airmanship, 22, The Marks of An Airmen: Establishing standards and overcoming obstacles in the search for professionalism (2004), 16, and Presentation Magazine PowerPoint Template, "Hexagon Jigsaw Diagrams."

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[10] Tony Kern, *Redefining Airmanship*, 22.
[11] Tony Kern, *Redefining Airmanship*, 22.

The Air Force focuses on flight discipline, skill, and proficiency from the beginning of pilot training to construct a foundation for airmanship. Kern describes flight discipline as "the ability and willpower to safely employ an aircraft within operational, regulatory, organizational, and common sense guidelines—unless emergency or combat mission demands dictate otherwise."[12] This definition focuses on three realms: physical, psychological, and cognitive. To maintain flight discipline a pilot must have the physical skill to fly an aircraft, psychological ability to make critical decisions and employ common sense, and the cognitive capacity to learn the required guidelines for safe operations. The ability to ignore "operational, regulatory, and organizational" guidelines stems from a strong foundation in all three realms of the definition and never disregarding common sense. [13] The Air Force starts constructing flight discipline during Initial Flight Screening academics, and in conjunction with the remaining two foundation pieces, it shapes the puzzle throughout a pilots' career.

The "proficiency puzzle" and Kern's foundation is strengthened with the principle of skill. Skill does not just encompass stick-and-rudder flying ability, but communication, leadership, and self-assessment skills.[14] A pilots' ability to accesses these skills and determine proficiency is imperative to developing airmanship. This requires self-discipline and commitment to continual improvement. According to Kern, development of pilot skill traverses four different levels and requires personal vigilance. The most basic level of skill is safety. To achieve the safety level, the pilot must demonstrate the basics of flying to safely operate the aircraft, but improvement is required. This skill level is usually where C-17 pilots are after the formal-training initial-qualification course. With additional skill development, a pilot transitions to the effectiveness level. At this level, the pilot can perform all flying duties without monitoring. For the C-17, this occurs sometime after mission-ready certification, approximately 500 hours in the aircraft and six months to a year of seasoning. Each pilot is different; individual motivation and aptitude determines skill-level progression. Pilots can plateau at the effectiveness skill level, especially without the drive to upgrade. A

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[12] Tony Kern, *Redefining Airmanship*, 29.
[13] Tony Kern, *Redefining Airmanship*, 29.
[14] Tony Kern, *Redefining Airmanship*, 50.

new C-17 pilot should be motivated to upgrade and progress to the third skill level; otherwise, the pilot's Air Force career could be limited. At the third skill level, efficiency, pilots are able to execute flying operations more skillfully than the standards. In the C-17 community, this skill level is achieved and required prior to training for upgrade to instructor pilot. A pilot who desires to become an instructor or evaluator pilot must operate safely, effectively, efficiently, and always be committed to striving for the final levels of skill, precision, and continuous improvement. The final level of skill is achieved by a few pilots, but the premise to "seek perfection, not as an obsession—but as a continuing motivation for personal improvement" should be desired by all professional pilots.[15] Chuck Yeager, arguably one of the greatest pilots in American history, challenged pilots to "seek to improve yourself—that's the mark of a true pro."[16] Kern's skill levels facilitate personal development and provide a realistic self-assessment tool.

The final foundational piece of the puzzle is currency. Air Force instructions direct a minimum number of repetitions and frequency for specific flying skills. For the C-17, AMC determines the continuation-training currency requirements using skill level and aircraft experience.[17] Currency requirements provide the minimum flight events in an attempt to provide an objective measurement for proficiency, but individual requirements are too diverse for minimum continuation-training currency requirements to alone equal proficiency. Proficiency remains a personal responsibility and directly results from a pilot's ability to assess flight discipline, skill, and currency. Kern reminds all pilots, "If you suspect that your individual capabilities are not what they should be, then you have a responsibility and moral obligation to get the problem fixed—or stay out of the sky."[18]

After framing the foundation of the puzzle, the interior hexagon pieces are required to complete the puzzle. Similar to Kern's pillars of knowledge the six pieces of the hexagon's outer ring support the centerpiece. These six pieces are knowledge of self, knowledge of aircraft, mission tactics, crew resource management, environment, and

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[15] Tony Kern, *Redefining Airmanship*, 53.
[16] Tony Kern, *Redefining Airmanship*, 48.
[17] A C-17 pilot's continuation training requirements are located in AFI 11-2C-17 Volume 1, table 4.4 (see appendix A).
[18] Tony Kern, *Redefining Airmanship*, 71.

risk.[19] These attributes encompass a broad spectrum of knowledge, leadership, and analysis required for proficiency. Alone each individual piece cannot solve the puzzle, but after integrating all six inside the framing pieces (flight discipline, skill, and currency) these pieces support a pilot's situational awareness and judgment. Each attribute facilitates a pilot's situational awareness or knowledge and interpretation of the scenario. As a pilot's knowledge, experience, and leadership expand, they open the aperture of situational awareness. This expansion allows the pilot to process more information and improve analysis to make decisions and take actions more efficiently and effectively. Situational awareness works in harmony with judgment. Every action a pilot makes on the ground and in the air requires situational awareness and judgment. The "proficiency puzzle" is an individual endeavor. It starts with pilot training and develops for the rest of a pilot's career. The framing pieces constantly require strengthening to ensure the puzzle maintains its circular shape and supports the attributes inside. The six interior pieces, supported by the framing pieces integrate to provide situational awareness and judgment, the centerpiece of the "proficiency puzzle." C-17 pilots must constantly focus on maintaining and improving their puzzle pieces. What pieces of the puzzle does the Air Force provide for a C-17 pilot to solve the proficiency puzzle?

C-17 Continuation Training

After finishing the C-17 pilot initial qualification course and in-processing to their operating base, new pilots start continuation training. Despite not being mission ready, pilots can still log continuation-training currency events. These events are included in the aircrew-ground, mobility, and semi-annual continuation-training flying-requirements table (see appendix A).[20] The currency events included in the ground-continuation training and the mobility-training requirements tables take a holistic approach to an aircrew's development of knowledge. For example, these tables' events consist of

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[19] Dr. Kern added mission tactics, a sixth pillar of knowledge in his 2004 article *The Marks of An Airmen: Establishing standards and overcoming obstacles in the search for professionalism.* The original airmanship model included only five: self, aircraft, team, environment, and risk.

[20] AFI 11-2C-17 Volume 1, *C-17 Aircrew Training*, 30-41. A C-17 pilot's continuation training requirements are located in AFI 11-2C-17 Volume 1, table 4.1, 4.2, and 4.4 (see appendix A).

quarterly computer-based training, instrument-refresher course, aircrew intelligence, water-survival training, small-arms training, aircrew chemical defense, and chemical, biological, radiological, nuclear and high-yield explosive training.[21] These events contribute to the pillars of knowledge and flight discipline, but do not concentrate on hands-on flying events for skill and proficiency.

The semi-annual continuation-training flying-requirements table provides a new pilot direction for a minimum number of flying events. These events include takeoffs, day and night landings, specific instrument approaches, day low-level flights, night-vision-goggle training events, and many more. In a semi-annual period a new C-17 pilot is required to complete over 70 events, and five additional are required on an annual basis.[22] These are hands-on flying events focused on repetition and practice. These maneuvers are imperative for physical and mental proficiency. The simulator (weapon system trainer – WST) can be used to accomplish 92 percent of the semi-annual and annual events. For a new C-17 pilot, time at the controls is critical, which drives Air Mobility Command's requirement for a minimum of four instructor-supervised tactical sorties. These sorties are local training flights with an emphasis on maximizing flying experience and repetition to drive proficiency in some of the most difficult skill maneuvers. During an instructor-supervised tactical sortie, a pilot must accomplish a minimum of four tactical events directed by the Air Force Instruction: "low level flight, tactical departure and high/low tactical arrival, [landing zone] LZ ground operations or [night vision goggle] NVG landing, LZ ground operations or NVG ground operations, NVG instrument approach, NVG assault landing, [or] air refueling."[23] In addition to these four sorties and accomplishing the minimum semi-annual continuation training flying requirements, a new pilot needs mission seasoning.

Accomplishing the mission is the goal of the nearly two years of training a new pilot. Mission experience and seasoning in all facets of the C-17's capabilities is critical

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[21] AFI 11-2C-17 Volume 1, section 7, provides a description for all the events identified in table 4.1, Aircrew Ground Continuation Training Requirements and table 4.2, Aircrew-Specific Mobility Training Requirements (see appendix A for the tables).
[22] Semi-annual period is from January thru July and August thru December. The calculated events are for a C-17 FPQ, flying training level C, non-airdrop and formation qualified pilot.
[23] AFI 11-2C-17 Volume 1, *C-17 Aircrew Training*, 93.

to continuation training. Once the C-17 pilot arrives at a main operating base, upgrade begins and complements continuation training. Each base has a process for pilot upgrade similar to the 60th Operations Group Pilot Upgrade Process, and each location's guidance encompasses the Air Force Instruction's minimum requirements. These requirements start in mobility pilot development (MPD) phase one. In this training, a pilot will concentrate on the six-outer-hexagon ring pieces of the puzzle through general knowledge studies in communication, airplane knowledge, and mission planning. Additionally, this phase builds upon a pilot's proficiency foundation, emphasizing checklist discipline and right-seat (co-pilot) flying skills.[24] The goal is to make an expert right-seat pilot with strong general knowledge, growing flying skills, and broader situational awareness of a C-17's capabilities and mission operations. To complete phase one the pilot must have 6 months of seasoning, a minimum of 200 primary hours (co-pilot or pilot hours), and have accomplished the training guide.[25] After completing these three prerequisites, a pilot moves to MPD phase two. Phase two focuses on Kern's transition from the safety skill level to the "effective" skill level through improved flying skills, knowledge, mission situational awareness, and crew leadership. A pilot in phase two can fly from the left or right seat and is encouraged to participate in leading the crew and managing the mission. Phase two is the last step before starting formal upgrade training for aircraft commander (left seat).[26]

To attend aircraft-commander-upgrade training, a pilot must complete the MPD phase two guide, fly 1000 total hours in the C-17 and 400 primary aircraft authorization hours, and demonstrate the performance, experience, and maturity for the squadron leadership to identify the pilot for upgrade. The normal progression to aircraft commander takes on average 24 months following C-17 pilot initial qualification.

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[24] AFI 11-2C-17 Volume 1, *C-17 Aircrew Training*, 54.

[25] Air Force Instruction (AFI) 11-401, *Aviation Management,* 10 December 2010, 60-64. Primary aircraft authorization (PAA) hours consist of primary flight time, "time actively controlling the aircraft," and secondary flight time, "occupying a duty position having a set of flight controls and not actively controlling the aircraft, instructing, or evaluating." Do not include simulator time or other time, the time when not occupying a duty position, actively controlling the aircraft, instructing, or evaluating.

[26] AFI 11-2C-17 Volume 1, *C-17 Aircrew Training*, 120. An aircraft commander is the "pilot who has been certified to perform 'pilot-in-command' duties," according to FAA and ICAO rules and regulations.

Upgrading to aircraft commander is not an entitlement, but a privilege; and the squadron's leadership identifies the best candidate, not the next in line. An aircraft commander is responsible for leading a crew and safely operating a $200 million aircraft worldwide. Before sending a pilot to aircraft commander upgrade, squadrons implement a training program to prepare candidates for training.[27] The 60th Operations group requires candidates to accomplish one air-refueling and assault-landing-zone training simulator and two flights, one day and one night. These events provide aircraft-commander candidates confidence and squadron leadership additional opportunities to evaluate performance, experience, and maturity. Aircraft-commander upgrade is phase three of the mobility pilot development and culminates approximately four years of training from initial flight screening thru C-17 pilot checkout.

C-17 continuation training guides a new pilot through the upgrade process, but addresses only the minimum requirements. From initial flight screening, pilot training, and C-17 pilot initial qualification, a new pilot is immersed in the physical, mental and psychological realms of flying. The pace and redundancy of training is rigorous and provides a strong foundation for skill, proficiency, and, most importantly, airmanship. After C-17 pilot initial qualification, training does not maintain a strict schedule. A new pilot must take personal responsibility for training and proficiency. The Air Force instructions provide minimum continuation-training currency and hours requirements, but the individual must provide the motivation.

The mobility air force's formula has maintained a proficient C-17 community since 1994. Through the course of 1.2 million flying hours since 11 September 2001 the community has thrived. Does mission completion and minimal safety incidents equal proficiency, or is it just good enough? Kern's performance evolution ladder, illustrated in Figure 3, illuminates the complications created when pilots are "good enough." The yellow highlighted section is "where we're good enough to get the job done; we're effective at what we do; we meet all the minimum standards but we are cohabitating with some fairly nasty bed fellows…that meeting the standards is not even good enough to

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[27] The aircraft commander upgrade course is formally called MPD pilot checkout (PCO) course, and is accomplished at the C-17 Flying Training Unit (FTU), Altus Air Force Base, Oklahoma.

stay safe."[28] The C-17 community has persistently operated in the efficiency and precision range. The C-17 crews are thriving on the mission training and seasoning. These missions challenge and fortify a pilot's knowledge, situational awareness, and judgment to increase proficiency as aircrews strive for perfection. Unfortunately redundancy and complacency may have led to some "good enough" situations.
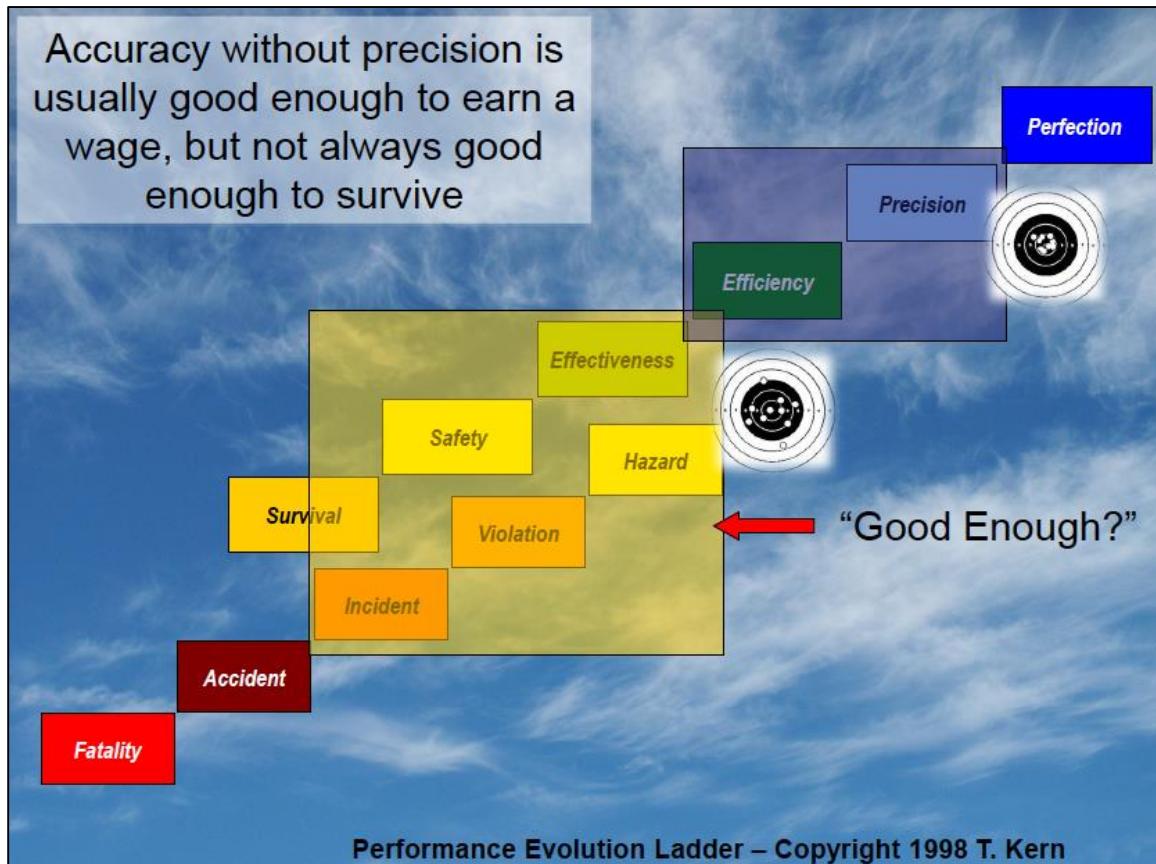
Figure 3: Dr. Tony Kern's Performance Evolution Ladder

Source: Reprinted from Wing Commander Mick Aspinall, Australian Defence Force, "Empowering Human Performance – Where do we go from here?" PACDEFF (The Pacific and Australasian CRM Developers' and Facilitators' Forum) Conference, 2011, slide 14, http://www.pacdeff.com/pdfs/MickAspinall PACDEFFReleaseFinal.pdf.

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[28] Dr. Tony Kern, "Professionalism" (lecture, Bombardier Safety Standdown USA, Whitchita, KS, 2011), http://www.safetystanddown.com/ knowledge-center/videos/. Dr. Kern discusses the performance evolution ladder and safety.

There have only been a few C-17 mishaps creating a small number of subjects for statistical analysis, but the results are still important. Since 11 September 2001, the C-17 community has experienced eight Class A mishaps.[29] Seven of these mishaps occurred during combat operations. In all seven of the mishaps, pilot error was a causal factor in the Accident Investigation Board's final report.[30] Additionally, six of the seven aircraft commanders had prior flight experience, but limited primary time in the C-17.[31] These pilots were either cross-flowed from another AMC aircraft, instructor pilots in training aircraft, or Operational Support Aircraft or Very Important Person Special Airlift Mission pilots. At the time of the accidents for the seven aircraft commanders, the mean primary hours were 543.5 hours and the median primary hours were 464.2 hours.[32] The fourteen remaining pilots mean was 235.2 primary hours. The pilot's primary hours were calculated by combining primary and instructor time for analysis.[33]

These C-17 mishap results correlate to Dr. Tony Kern's flight experience analysis. Kern cites a Navy mishap study from 1992, "pilots with less than 500 flight hours in model were at significantly greater risk for pilot error mishap factors."[34] The Navy's study analyzes mishaps in connection to primary-time statistics for fighter and attack aircraft from FY 85 thru 90. Additionally, the Navy "found no correlation between total flight hours and accident rates, indicating that aviators transitioning to new aircraft

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[29] Air Force Instruction (AFI) 91-204, *Safety Investigations and Reports*, 24 September 2008, 15-16. "Class A mishap - A mishap resulting in one or more of the following: direct mishap cost totaling $1,000,000 or more; a fatality or permanent total disability; destruction of a DoD aircraft."

[30] Executive summaries of these mishaps are located on the Air Force Accident Investigation Board reports website. This study analyzed seven of the eight AMC Class A mishaps since 11 September 2001. http://usaf.aib.law.af.mil/index.html

[31] Air Force Instruction (AFI) 11-401, *Aviation Management,* 10 December 2010, 60. Primary flight time, "time actively controlling the aircraft."

[32] One of the aircraft commanders had over 1000 primary hours and another had nearly 800 hours, but the remaining six aircraft commander had a mean of 327 primary hours.

[33] AFI 11-401, Aviation Management, 10 December 2010, 63. Instructor time "includes 'hands on' time during demonstration activities that are part of instructional duties." This study excluded secondary time because the pilot is "not controlling the function of the [aircraft]." During primary and instructor time, the pilot is in physical control of the aircraft similar to the Navy fighter and attack aircraft study.

[34] D.W. Yacavonne et al, "Flight Experience and the Likelihood of U.S. Navy Aircraft Mishaps," *Aviation, Space, and Environmental medicine* 63, no. 1 (January 1992): 72. As cited in Tony Kern, Redefining *Airmanship,* 57-58.

are at increased risk as well as pilots who are checking out in their first aircraft."[35] The correlation between the Navy's fighter and attack aircraft study and the C-17 combat mishaps suggests the C-17 mishaps are not unique to a specific aircraft. Training deficiency is applicable in all aircraft and the analysis of the experienced pilot in a new aircraft is relevant across AMC. These two studies conclude that time-in-type is a pilot-experience phenomenon, and pilots with fewer than 500 hours of primary time are at an increased risk. It is leaderships' obligation to provide training to mitigate the risk.

The Air Force is always going to have inexperienced pilots. These pilots fulfill a requirement to get the mission accomplished and gain experience to train the next set of pilots. The C-17 safety incidents highlight a new pilot's inexperience, but more importantly an experienced pilot's struggle with skill, knowledge, and judgment in a new aircraft. The "proficiency puzzle's" pieces strengthen these attributes and focus on a solid foundation. The puzzle's framing pieces requires new pilots to construct and enforce the foundation, and experienced pilots need to reconstruct fundamentals in a new aircraft. Kern's levels of skill are a tool leadership can use to look at both of these pilot's categories. The Navy's study and C-17 mishap solidify a new C-17 pilot in the "safety" skill level until approximately 500 hours of primary time. An experienced pilot new to the C-17 should be beyond the "safety" skill level, but not fully operating proficiently at the "effectiveness" level, especially with all the responsibilities of an aircraft commander in a new aircraft. The guideline from AMC for certification as an aircraft commander after cross-flowing to the C-17 is 1000 total flying hours and 100 primary aircraft authorization hours in the C-17. To make this requirement easier to achieve, simulator time is permitted for the total flying hours.[36] Similar to using currency to equal proficiency, these are minimal objective goals for a subjective decision. *The squadron leadership and ultimately the commander must consider every individual pilot's proficiency when certifying a new aircraft commander.* Are crews operating in the "efficiency and precision" section of Kern's ladder striving for perfection or are they settling for "good enough?" Can the Air Force meet a C-17 pilot's training, seasoning, and proficiency requirements; or will fiscal constraints drive mission failure, or worse, a

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[35] Tony Kern, *Redefining Airmanship*, 58.
[36] AFI 11-2C-17 Volume 1, *C-17 Aircrew Training*, 52-53.

safety mishap? The third chapter analyzes the future proficiency puzzle after years of intense mission flying hours.

CHAPTER 3

The Environment: Flying Thru Money and Hours

The centrality of the flying hour program to readiness and combat capability cannot be overemphasized. It must be defendable and audible. To that end, it must be standard across the Total Air Force, connected to readiness indicators, based on the train-to-talk concept, easily understood, and most importantly, based upon the requirements to train and experience aircrew to perform required Air Force missions.
Air Force Instruction 11-102, *Flying Hour Program Management*

Sequestration triggered an automatic budget reduction for the Federal government. The Department of Defense had to make budget reductions across all programs and critical decisions affecting military readiness.[1] Flying hours are central to operational readiness and training. Following sequestration the Air Force will "[reduce] flying hours by as much as 18 percent ([approximately] 203,000 hours across the enterprise)."[2] The decision to decrease flying hours provides a lucrative offset for the programming and budget office, but will cripple the Air Force's training and readiness. The Air Force has operated through reduced flying hours in the past, and in the current fiscally constrained environment, more flying-hour reductions are imminent. To fully understand the second-and third-order effects of reducing flying hours it will prove important to conduct a historical analysis of flying hours; because like the quote commonly attributed to Mark Twain, "history does not repeat itself, but it may rhyme."[3]

This chapter examines the current fiscal environment and historical budgets to provide insight for the flying hours in the future. Next, this work investigates Instructional System Development (ISD) and the strengths and weaknesses of leveraging technology to replace flying. Finally, this chapter will examine the unique mission sets of the C-17 and the associated training.

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[1] Gen Mark A. Welsh III, Chief of Staff, United States Air Force, e-mail to Airmen of the United States Air Force, 1 March 2013.

[2] Jamie M. Morin, Under Secretary of the Air Force, to Under Secretary of Defense (Comptroller), memorandum, 1 February 2013.

[3] James A. Duthie, *A Handbook for History Teachers* (Lanham, MD: University Press of America, Inc., 2012), 6.

Budget History
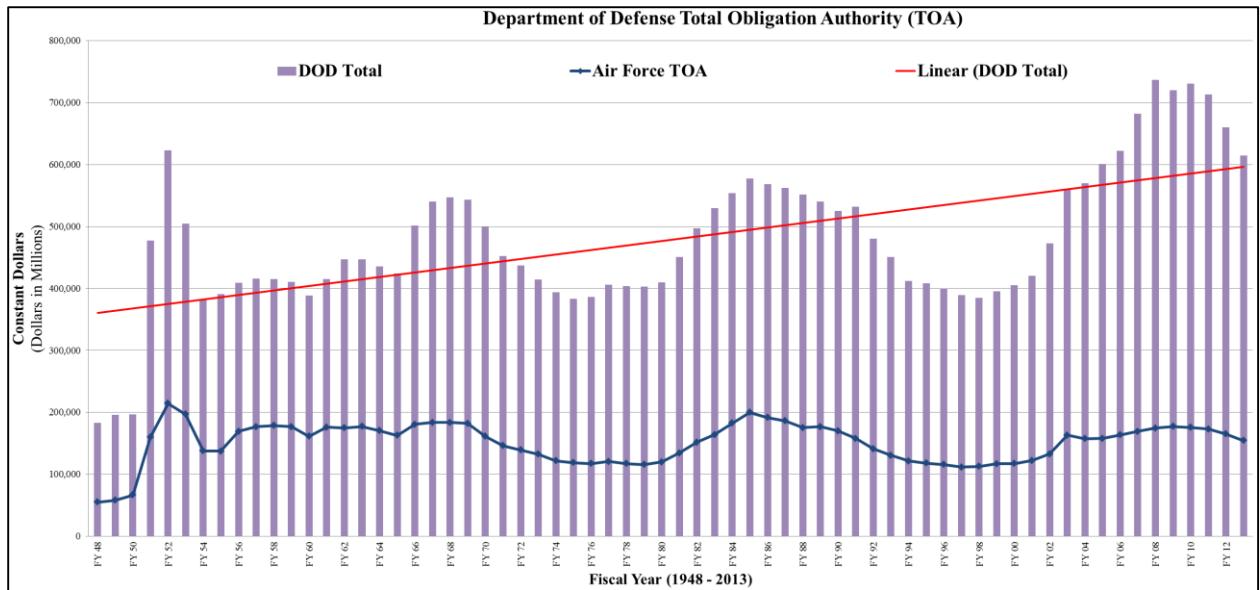
Figure 4: Department of Defense TOA FY 48 – 13

Source: Adapted from Department of Defense, National Defense Budget Estimates for FY 2013, Office of the Undersecretary of Defense (Comptroller), March 2012, http://comptroller.defense.gov/defbudget/fy2013/FY13_Green_Book.pdf, 95-101.

Sequestration created a volatile fiscal environment and a fierce competition for funding. Similarities exist between the current crisis and past budget cutbacks. These similarities may provide insight into the effects of fiscal reductions. Since fiscal year (FY) 1948, the first fiscal year after the National Security Act of 1947, the Department of Defense has experienced cycles of budget gains and reductions. Figure 4 shows the Department of Defense's and the Air Force's Total Obligation Authority (TOA) in constant dollars from FY 48 thru FY 13. Constant or real-dollar calculations allow comparison, in this case, over the course of sixty-five years adjusted for inflation, illustrating the peaks and valleys throughout the DOD history. [4] Historically the budget rises at the onset of a war and declines after the peak of wartime operations. This observation is illustrated with the buildups in FY 51, 66, 82, 91 and 02 as the nation prepared for the Korean War, Vietnam War, climactic battle of the Cold War, Gulf War, Operation Enduring Freedom, and Iraqi Freedom respectfully. Subsequently the

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[4] United States Census Bureau, "Income: Current versus Constant (or Real) Dollars," United States Department of Commerce, http://www.census.gov/hhes/www/ income/data/historical/dollars.html (accessed 14 March 2013).

Department of Defense reduced the budget after achieving the desired results and cut back military spending to support leaner peacetime operations. This cyclical effect provides data points that may help illuminate strategy and policy for the Department of Defense.
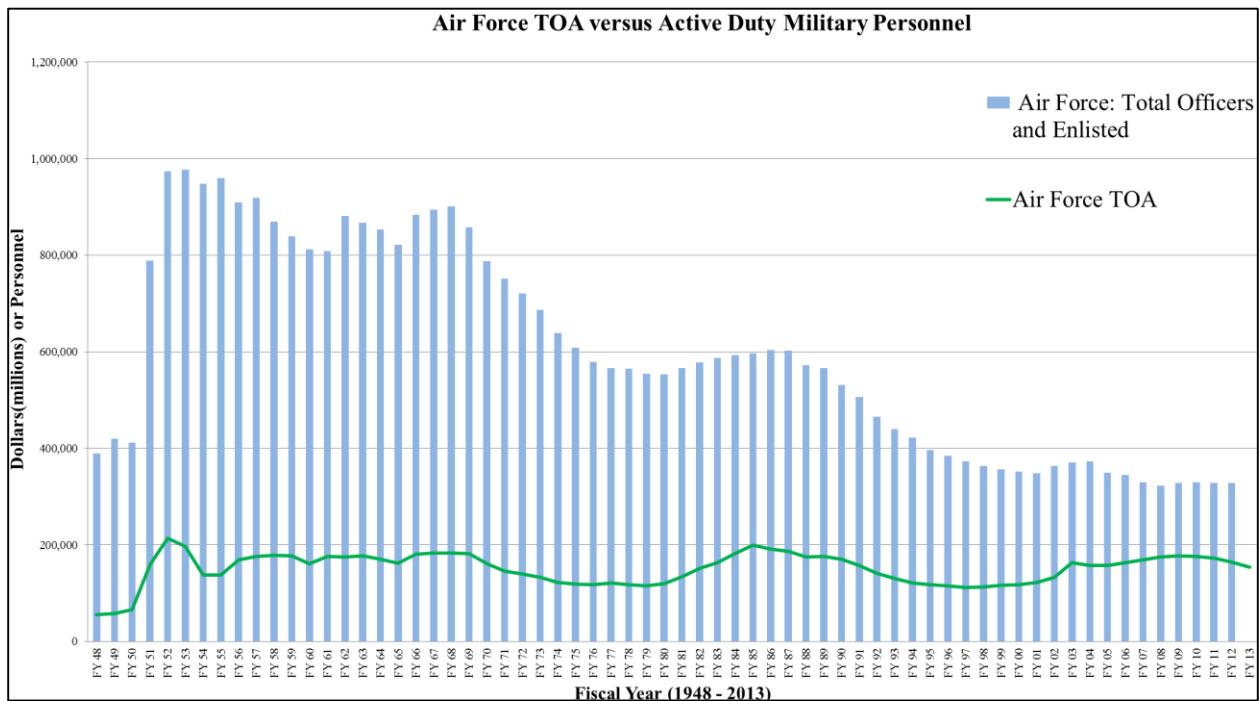
Figure 5. Air Force TOA versus Active Duty Military Personnel FY 48 - 13

Source: Adapted from multiple sources, see bibliography for National Defense Budget Estimates for FY 2013, and Air Force Strength from FY 1948-2012.

The current fiscal crisis contradicts historical tendencies, specifically in Air Force personnel statistics. Traditionally personnel gains and losses follow proportionally the budget trend, but with the rising costs of personnel, the trend is now diverging. In fiscal year 2013 "the cost of military pay and allowances, along with those for military health care, make up about one third of the Department's budget and have [grown] rapidly in recent years – up almost 90 percent since FY 01 (about 30 percent more than growth by inflation) while active duty end strength has grown by less than 3 percent."[5] Figure 5 illustrates the correlation between the Air Force's budget and personnel since 1948.

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[5] Department of Defense, "Overview – United States Department of Defense Fiscal Year 2013 Budget Request," Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer, February 2012,

History illustrates the cyclical pattern of the Defense budget, but the Department has never confronted personnel costs that comprise almost one third of the entire budget. The Department of Defense is attempting to prevent the growth of personnel costs and has a future plan for responsible spending reductions.[6] Planning, Programming, Budgeting, and Execution (PPBE) represents a zero-sum game; and as the budget decreases and personnel costs rise, the amount and quality of training, readiness, and operations will likely decline. An important element of readiness and training for the Air Force is the Flying Hour Program (FHP). This program competes for funding through the Air Force Corporate process. Historical investigation and process analysis will provide insight to shape the Flying Hour Program in the future during budget cutbacks.

Flying Hours Calculation and History
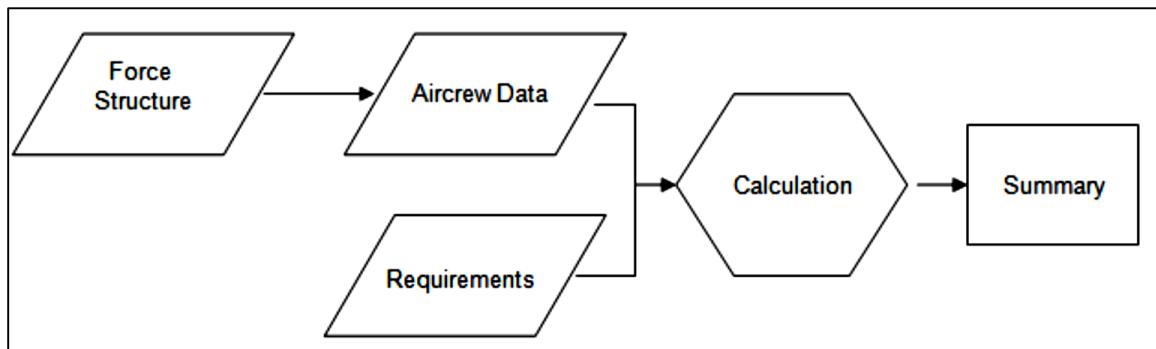
Figure 6. The Air Force Single Flying Hour Model

Source: Reprinted from Air Force Instruction (AFI) 11-102, Flying Hour Program Management, 30 August 2011, 4.

"The Air Force Flying Hour Program is a requirements-based, peacetime program consisting of the flying hours necessary to train aircrews to safely operate aircraft while sustaining them in numbers sufficient to execute the core tasked mission."[7] Major

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http://comptroller.defense.gov/defbudget/fy2013/FY2013_Budget_Request_Overview_Book.pdf (accessed 19 March 2013), 5-1 (43).

[6] DOD, "Overview – United States Department of Defense Fiscal Year 2013 Budget Request," Chapter 5. The DOD describes Future Year Defense Programs (FYDP) outlook for military compensation changes, the military health system, retirement modernization, and DOD civilians.

[7] Air Force Instruction (AFI) 11-102, *Flying Hour Program Management*, 30 August 2011, 2.

Commands (MAJCOM) prepare flying-hour programs with the Single Flying Hour Model shown in Figure 6. This model provides the basis for the mathematical calculations beginning with the force structure and crewmembers required to operate the aircraft. To determine the required number of crews the Primary Aircraft Inventory (PAI) is multiplied by the crew ratio.[8] Then MAJCOMs build the aircrew data from the required force structure and determine the breakdown of experience, crew-position upgrades, and special qualifications.[9] Separately each MAJCOM determines the training and operational requirements for each crew position. Managers for each aircraft specify these requirements in 11-2 Major Design Series (MDS) volume one (AFI 11-2C-17 vol 1) Air Force Instruction training manual.[10] Each weapons system's requirements are different, and the MAJCOM prepares separate requirement factors. In addition to the requirements for each crewmember, an "aging factor" or "experiencing" calculation is required for the computations.[11] Crew force-development and experience are predicated on the use of an aging rate in the flying-hour program. Subsequently, the calculation step, in its simplest terms, is multiplying the aircrew data by the requirements. Programmers also add Cost of Business (COB) hours for attrition sorties, force sustainment, or force support.[12] Finally, after summarizing the hours needed to fulfill the requirements and adding the Cost of Business hours, the MAJCOM can publish the flying hours obligated for a specific aircraft.

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[8] Department of the Air Force, "A36-1 Authorized Aircrew Composition (Regular)," Air Force Portal, Financial Management, Air Force Instruction (AFI) 65-503, Cost Factors: Factors Tables, https://www.my.af.mil/gcssaf/USAF/ep/browse. do?categoryId=p6925EC163B560FB5E044080020E329A9&channelPageId=s6925EC13 50500FB5E044080020E329A9 (accessed 19 March 2012). This table includes the authorized aircrew composition for the active Duty. The current table, 1 February 2012, authorizes a 3.0, C-17 crew ratio (three crews to every one C-17 aircraft) for planning purposes.

[9] AFI 11-102, *Flying Hour Program Management*, 5.

[10] AFI 11-102, *Flying Hour Program Management*, 5.

[11] AFI 11-102, *Flying Hour Program Management*, 6.

[12] AFI 11-102, *Flying Hour Program Management*, 7-8. "Attrition sortie; any sortie or mission that did not execute the original intent of the mission as scheduled due to unforeseen reasons." "Force Sustainment; any sortie or mission in support of unit training or currency." "Force Support; any sortie or mission not scheduled to support Ready Aircrew Program (RAP) or Continuation Training (CT)."

Following the calculation of the flying hours obligated for the aircraft, the MAJCOM adds the pricing to the program. Air Force Instruction 65-503 and specifically table A4-1 provide planning factors to the programmer.[13] Table A4-1 incorporates multiple variables into its pricing calculation and is intended for the programming objective memorandum (POM) and submittal of the President's budget.[14] Table 7 shows an example of the cost factors and total flying hour cost per major design series aircraft. For the C-17 in FY 13 the planning cost is $13,758 per flight hour, which includes the cost of fuel at $3.73 per gallon. The planning cost per flight hour, changes during budget execution based on multiple variables: aviation fuel, depot maintenance, and general and material support. Fuel cost is a variable in flying-hour pricing, which can dramatically increase or decrease during budget execution despite efforts to fly in a more energy-efficient manner.[15] Flying-hour cost is extremely important when discussing readiness and training due to the zero-sum game of budgeting and the fiscal reductions likely in the future. The history of C-17 flying hours can provide a basis to guide the Air Mobility Command to a balance between fiscal restraints, flying hours, and readiness.

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[13] Air Force Instruction (AFI) 65-503, *US Air Force Cost and Planning Factors*, 4 February 1994, 2.

[14] Department of the Air Force, "A4-1 Logistics Cost Factors," Air Force Portal, Financial Management, AFI 65-503, Cost Factors: Factors Tables, https://www.my.af.mil/gcss-af/USAF/ep/browse.do?categoryId= p6925EC163B560FB5E044080020E329A9&channelPageId=s6925EC1350500FB5E044 080020E329A9 (accessed 19 March 2012).

[15] FY12 fuel cost was $3.95 per gallon and AMC programed to fly 13,134 operations and maintenance hours for a total cost of $186.0 million and if the cost of fuel decreased to $3.85 the total cost of $182.4 million would save AMC $3.6 million after a 10 cent change in the fuel price per gallon.

Table 7: AFI 65-503 Table A4-1 Logistics Cost Factors – FY 11 Example

MDS	Fuel Cost	GPC	GSD	MSD	DepotMaint 4-3CPFH	CLS5-2CPFH	Total FH Costs	DepotMaint 4-1CPPAA	CLS5-2CPPAA	Support Equip Replacement	Total PAA Costs
AFI 65-503 Table A4-1 FY 2011 LOGISTICS COST FACTORS											
Fuel price is $3.03/gallon											Last updated: October 2010
C-17A	$8,810	$27	$138	$208	$1	$2,474	$11,658	$0	$4,408,266	$11,347	$4,419,613
T-1A	$565	$1	$8	$0	$0	$595	$1,169	$0	$59,602	$781	$60,383
T-6A	$199	$2	$10	$1	$0	$218	$430	$0	$66,131	$1,263	$67,394

Source: Adapted from: Department of the Air Force, "A4-1 Logistics Cost Factor Table 25 October 2012," Air Force Portal, Financial Management, AFI 65-503, Cost Factors: Factors Tables.

The C-17 is AMC's newest aircraft. The first operational aircraft reached Charleston Air Force Base on 14 June 1993, and the aircraft has flown from Antarctica to Afghanistan, in combat, aeromedical evacuation, and humanitarian operations, and has proven itself as the "most flexible cargo aircraft to enter the airlift force."[16] "During FY 00 and 01, the CPs [copilots] of all airlifters and tankers encountered a flying-hour shortage because the international situation was relatively calm and there were fewer U.S. missions that called for airlift support."[17] The international landscape during this shortage may provide insight into the posture required for operations after Operation Enduring Freedom. Fiscal years 2000 and 2001 were the last two years of peacetime operations; since then the C-17 community has experienced 12 years of combat flying. An analysis of flying hours reveals a dramatic effect on the C-17 community.

Funding for C-17 flying hours originates from two different sources: the operation and maintenance (O&M) fund and the Transportation Working Capital Fund (TWCF). Simply explained, O&M hours support training and TWCF provides for mission accomplishment. This simplistic view of the complex flying hour funding process provides a rough baseline; however, there are many exceptions to this perspective. Operations and maintenance funding provides continuation training, upgrades, and maintenance or test-focused flying hours. It does not provide sufficient hours for

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[16] Department of the Air Force, "C-17 Globemaster III," Fact Sheet, 29 December 2011, www.af.mil/information/factsheets/factsheet.asp?id=86 (accessed 18 March 2012).

[17] Brian G. Chow, *The Peacetime Tempo of Air Mobility Operations: Meeting Demand and Maintaining Readiness*, RAND Project Air Force Report (Santa Monica, CA: RAND, 2003), xvi.

experiencing or aging.[18] TWCF missions provide AMC opportunities for experiencing and aging hours. Through O&M and TWCF, the flying hour program managers program hours to complete the currency requirements dictated through Air Force Instruction 11-2C-17 Volume One (see appendix A), age the crew force, and strive for proficiency.[19] This quantity balancing is what the Air Mobility Command A3TR determines before programming flying hours.

Figure 7 illustrates the historic balance between TWCF and O&M hours. It depicts the programmed versus actually flown hours per aircraft since FY 00. The substantial increase in O&M hours from FY 00 to 01 was AMC's attempt "to increase organic flying during the second half of FY 01," to reduce the flying-hour shortage it experienced during previous months and the O&M hours accomplished the reduction. [20] This trend begins again in 2013 to balance for the mission reductions predicted by United States Transportations Command (USTRANSCOM) in the future. AMC programmed 81,552 TWCF hours compared to 110,350 hours for FY 12, resulting in a loss 28,798 hours. With the loss of TWCF hours, AMC programmed more O&M hours (19,264) for FY 13.[21] These additional hours are essential to seasoning the crew force and fulfilling aircrew requirements calculated with the single flying-hour model.

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[18] AFI 11-102, *Flying Hour Program Management*, 6. Experiencing or aging calculation provides a pilot to "accumulate hours permitting them to upgrade at a minimum rate to support planned absorption and crew qualification requirements to maintain a unit's capability to fulfill its assigned missions."
[19] The flying hour program managers for AMC work in A3TR and are the experts.
[20] Brian G. Chow, *The Peacetime Tempo of Air Mobility Operations: Meeting Demand and Maintaining Readiness*, 23.
[21] Air Mobility Command, A3TR, "C-17 FY13 Flying Hour Program," Excel Spreadsheets, https://afkm.wpafb.af.mil/community/views/home.aspx?Filter=AM-OP-00-05 (accessed 20 January 2013).

O&M and TWCF Flying Hours vs Actual Flying Hours per Aircraft from FY 2000-2013 (Active Duty)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Pgm'd O&M Hours/PAI	283.73	374.94	158.21	157.11	193.70	182.90	161.88	155.13	124.02	125.22	115.02	123.55	105.92	155.35
Actual O&M Hours/PAI	277.68	363.33	157.20	156.09	190.22	182.79	159.84	153.15	123.81	123.99	113.67	122.57	105.40	52.58
Pgm'd TWCF Hours/PAI	822.11	820.37	1,016.09	1,273.07	986.13	882.51	651.38	656.96	675.31	856.45	990.32	979.03	889.92	657.68
Actual TWCF Hours/PAI	790.76	768.90	930.90	945.32	710.95	718.29	663.24	650.12	686.11	849.55	995.62	973.89	890.02	365.77

Figure 7. O&M and TWCF Programmed Flying Hours versus Actual Flying Hours per Aircraft FY 00 - 13

Source: Adapted from AMC/A3TR, "C-17 FY00-13 Flying Hour Program," Excel Spreadsheets, (compiled 20 January 2013.)

The balance between TWCF and O&M required flying hours can be ameliorated somewhat as technology and Instructional Systems Development increases the usefulness of simulators and part-task trainers. In addition to the use of new and improved technology, requirements change as the mobility air force's mission adapts to the current national military strategy and fiscal restraints. These developing technologies and requirements could drive a reduction in required flying hours. The next section will explore the technology medium to augment flying hours and aid proficiency in today's fiscal environment.

Leveraging the Technology Medium

The current fiscal climate drives the Air Force to achieve mission effectiveness utilizing innovative approaches. Proficiency and airmanship are perishable skills and, similar to a golf swing, require practice. Jack Nicklaus, one of the greatest professional golfers, said, "No matter how motivated you already are as a golfer, or want to become, it isn't going to move you one step forward if you can't hit a golf ball halfway

46

decently…So how do you become a better shot-maker? Obviously, through practice.
But there's really an awful lot more to learning to hit good golf shots than belting out a
few million balls…Practice alone won't do it—you must practice it the right way."[22]
Like golf, flying requires practice, consistency, and confidence. The best medium to use
for skill proficiency and airmanship is the aircraft. No other medium provides the same
mental, physical, and psychological feedback. If the Air Force had a larger budget top
line, lower personnel costs or less mission contraction, funding flying hours would be
easier. However, given the pending drawdowns in operations as well as fiscal challenges,
flying hours will likely be targeted for reduction. During testimony to Congress, Air
Force Secretary Michael Donley said, "Flying hour reductions will halt training for the
rest of the year in many units and [it] will take up to six months to restore pilot
proficiency."[23] These reductions have forced difficult decisions concerning readiness.
Although technology provides some options for retaining and improving proficiency and
readiness while lowering the cost to the Air Force, technology cannot be considered a
direct replacement for hands-on time in the aircraft. Nonetheless…

Full Motion Simulators

"The flight simulator designer's goal must be focused on creating an environment
where pilots will behave in a manner comparable to their behavior in the aircraft and
whose experience in the simulated aircraft will be indistinguishable from that of the
aircraft."[24] Simulators are cost-effective, convenient, and provide an excellent training
platform for proficiency. Simulator technology has drastically improved, resulting in
more fidelity and a stronger transfer rate to the aircraft. Simulators provide a platform for
emergency-procedures training and currency-event repetition, but also provide the
military additional opportunities. For the mobility air forces specifically, the simulator

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[22] Howard E. Ferguson, *The Edge: The Guide to fulfilling Dreams, Maximizing Success and Enjoying a Lifetime of Achievement* (Cleveland, OH: Getting the Edge Company, 1990), 3-28.

[23] Sergeant First Class Tyrone C. Marshall, Jr., "SecAF discusses $114.1 billion budget proposal," *American Forces Press Service*, 12 April 2013, http://www.af.mil/news/story.asp?id=123344271 (accessed 15 April 2013).

[24] Alfred T. Lee, *Flight Simulation: Virtual Environments in Aviation* (Burlington, VT: Ashgate Publishing Company, 2005), 99.

allows tactics testing. Tactical scenarios can be loaded and tested with precise environmental settings, aircraft weight, and threat conditions. The crew can determine the best tactical course of action, practice multiple times without the stress of combat, and then transfer this knowledge to execute the mission. This is only one example of the versatility and strengths of simulators.

However, despite the strengths and technological advancements, leadership and crews need to understand the limitations of simulators to increase training effectiveness. First, there are significant psychological differences between simulator flying and aircraft flying. It starts with the first step into a simulator building as opposed to the flight-line. Then the crew briefing consists of a discussion of systems knowledge and events. After the briefing, the crew walks the short distance to the simulator and climbs into a climate-controlled, pristine flight deck. All these steps are different from flying the aircraft. Additionally, "despite every attempt to create an environment that will 'immerse' the pilot in the flying task, the simulator cannot expose the pilot to the inherent hazards associated with actual flight."[25] The adrenaline crews receive when preparing for and during a flight, when faced with a potentially fatal situation is not present in a simulator sortie. For military crews this psychological phenomenon and physical limitations are more prevalent in air refueling, low level, airdrop, formation, and tactical operations. Full-motion technology does provide a similar feeling for most aspects of flight, but it falls well short of the required experiences one needs to develop psychologically. This psychological phenomenon is similar to the difference in a golfer's mindset when practicing on the driving range versus on the first tee box at the Masters.[26] Simulators cannot provide the mental dynamics that are vital in pilot development and solving the "proficiency puzzle." A pilot in a simulator is like a golfer on the driving range; they both are practicing the right way, establishing muscle memory and procedural consistency, but the psychological mindset and mental pressure cannot be simulated. There is a fundamentally different approach to a simulator sortie. Crews and leadership need to be aware of the limitations in order to psychologically create a better environment

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[25] Lee, *Flight Simulation: Virtual Environments in Aviation*, 105.
[26] The Masters is one of the four major professional golf tournaments played each year and as such, it is one of the most intense tournaments.

through intense crew mental preparation and realistic training scenarios. Finally, given the need to remain proficient and considering the previously recognized context (decreased hours and funding) simulators must be central to the proficiency process.

Each C-17 base maintains a rigorous Weapon System Trainer program.[27] The C-17 WST is a "simulator device that provides synthetic flight and tactics environment, in which aircrews learn, develop, improve, and integrate skills associated with their crew position."[28] The simulator provides the most realistic virtual environment for practice operations. The C-17 WST is "a high-fidelity, full-motion simulator exactly replicating the C-17 flight deck. The simulator has a high-resolution day [and] night visual system with a 225-degree field of view from flight deck windows... [and] is night vision goggle compatible."[29] The realistic sounds, motion, and visual effects in the simulator provide a critical training environment. It does not perform identically to the aircraft, but it can simulate all the required mission sets necessary for operating the C-17.

Each main operating base has at least one weapon system trainer. It can operate for 20 hours a day, 350 days a year resulting in 7,000 hours of possible training.[30] During the remaining four hours in the day, the simulator requires updates and maintenance. The most effective use of a WST would be 16 hours a day 350 days a year. This provides 5,600 hours for an 80 percent utilization rate and allows the maintainers to perform regular, extensive preventative maintenance during 8 hours of nonscheduled time. Furthermore, it allows the aircrews an additional 4 hours daily of "surge" time to meet the unit-deployment and mission-essential requirements.[31] The C-17 WST is equivalent to a

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[27] Active duty operational bases in Air Mobility Command: Joint Base Charleston, four WST; Dover Air Force Base, one WST; Joint Base McGuire-Dix-Lakehurst, one WST; Travis Air Force Base, one WST; and Joint Base Lewis-McChord, four WST. There are a total of 11 C-17 WST.

[28] Air Force Instruction (AFI) 11-2C-17 Volume 1, C-*17 Aircrew Training*, 1 June 2012, 124.

[29] Stacey Holloway, "Integrated Defense Systems: 'I want to do that!' C-17 is at the center of Ralph Mead's career with the Air Force, Boeing," *Boeing Frontiers*, vol. 7, issue 8 (December 2008/January 2009): 32-33, http://www.boeing.com/news/frontiers/archive/2008/december/i_ids03.pdf.

[30] Terry Wydeven (Project Officer/Quality Assurance Representative C-17 Training Systems, Dover Air Force Base, DE), email correspondence with author, 16 April 2013.

[31] Darrol Prill (Project Officer/Quality Assurance Representative C-17 Training Systems, Travis Air Force Base, CA), email correspondence with author, 16 April 2013

Federal Aviation Administration (FAA) level C+ simulator, which allows it to conduct visual and instrument flight currency and evaluation similar to the commercial airlines.[32] The WST can simulate all the flying maneuvers required for the mission, including night vision goggle training, airdrop, low level, and air refueling. The WST's technology provides a simulated reality, with enough fidelity, for a new C-17 pilot to execute 92 percent of the flying requirements for semiannual continuation training (see appendix A). A new C-17 pilot will accomplish six simulator sorties in the first full semi-annual cycle. Each simulator period is three hours; therefore, over the course of a semi-annual period a new C-17 pilot logs 18 hours of mandatory training in the simulator. These six simulators consist of two proficiency simulators, which concentrate on sharpening a pilot's skills in the individual's weak areas or the C-17 community's special interest areas. In addition, a pilot will fly one two-day phase simulator every quarter, focusing on continuation training, emergency procedures, and skill development. The simulator cannot meet training requirements for a few events in the C-17 aircraft. These limitations focus on the specialized mission sets: air refueling, formation, airdrop, and assault landings. Despite the limitations, simulators are an outstanding training tool and help refine aircrews' flying skills and expose crews to a broad spectrum of scenarios, especially emergencies and tactical training.

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[32] Darrol Prill (Project Officer/Quality Assurance Representative C-17 Training Systems, Travis Air Force Base, CA), email correspondence with author, 22 January 2013. The FAA does not certify the C-17 WST, but the Air Force utilizes the same criteria from Advisory Circular 120-40B. The C-17 simulator's sound and visual fidelity is slightly less than the level required for Level D certification, the FAA's highest certification.

Computer Based Systems

Figure 8. C-17 Reprogrammable Desktop Simulator (RPS)

Source: Reprinted from Terry Wydeven, Project Officer/Quality Assurance Representative C-17 Training Systems, Dover Air Force Base, DE, email correspondence with author, 16 April 2013.

Simulators come in all shapes and sizes and through technological innovation C-17 pilots can fly a Reprogrammable Desktop Simulator (RPS). Figure 10 is a depiction of the C-17 RPS at Dover Air Force Base Delaware. Each main operating base possesses one RPS. In initial qualification training, students are introduced to the Reprogrammable Desktop Simulator and use it multiple times for procedural training. The switches and indicators are located on multiple monitors and it provides a platform for in-depth mission computer practice, which is essential to a new C-17 pilot's development. It also simulates flight without motion, similar to a Microsoft Flight Simulator program. The Reprogrammable Desktop Simulator is significantly cheaper than the Cockpit Systems Simulator, which is a full replica of the C-17 flight deck, but does not offer the quality of hands-on training. Additionally, training events cannot be logged in the Reprogrammable Desktop Simulator. It operates on the lower end of the technology

scale for simulators, but it offers an opportunity to work through scenarios and refine procedural skills to enhance proficiency.

Another technological training aid every main operating base utilizes is computer-based training (CBT). During initial qualification, students become familiar with CBTs through over 75 hours of training. During initial qualification, students learn aircraft systems, procedural training, emergency procedures, and flight planning.[33] Every quarter, before a pilot's phase simulators, computer-based training is completed. This training concentrates on yearly training: hazardous cargo, anti-hijacking, and aircraft servicing. It also refreshes the pilot's system and procedural knowledge. Quarterly phase computer-based training is "the primary method of instruction in the C-17."[34] This training offers a technological supplement to a pilots' systems and procedural knowledge from the flight manuals.

Technology can play a role in the future to increase cost savings and maintain a proficient force. An hour in a C-17 Weapon System Trainer's costs about $650, depending on the instructor support and a few other contractual variables.[35] This is a fraction of the $17,896 per training hour for AMC to operate the aircraft.[36] In addition to fiscal savings in flying hours, the simulator reduces structural wear and tear on the C-17 fleet, provides more aircraft for operational missions, and provides pilots opportunities to practice emergencies, test tactical data, and practice the right way. Despite the cost of flying hours, pilots still need to fly, and some unique missions in the C-17 need additional training. In other words, the use of simulator technology to enhance a C-17 pilot's proficiency is necessary, given current restraints, but simulator use is not sufficient.

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[33] Air Education and Training Command (AETC) Syllabus C-17PIQ, *C-17 Pilot Initial Qualification (PIQ) (FMS Included)*, December 2011, 9-13.
[34] AFI 11-2C-17 Volume 1, C-*17 Aircrew Training*, 84.
[35] Air Mobility Command A3TA, "C-17 AMC standard cost per hour," email correspondence, 17 April 2013.
[36] Air Mobility Command A3TR, "FY13 AMC C-17 cost for one training hour," email correspondence, 11 March 2013.

Unique C-17 Missions

The C-17 offers some unique capabilities to AMC, the Air Force, and the Department of Defense. The aircraft's flexibility provides tactical airlift, airdrop, precision airdrop, and aeromedical evacuation support. C-17 operations span from an assault landings on a 3,500-foot long runway to airdropping supplies for humanitarian missions worldwide.[37] These complex capabilities require extensive proficiency. Extensive proficiency requires training, flying hours, and funding.

The tactical airlift mission provides the capability to deliver 170,900 pounds of cargo or 102 warfighters to an austere airfield worldwide. The crews train to infiltrate an airfield at low level, 300 feet above ground or 500 feet above the highest obstacle on night vision goggles, and execute an assault landing on a 3,500-foot long by 90-foot wide surface.[38] An assault landing can be executed from a high or low-altitude approach, and all C-17 pilots maintain this capability. Another capability all C-17 pilots can accomplish is aeromedical evacuation. This is one of the C-17 crews' most rewarding missions. The crew configures the aircraft to support aeromedical evacuation personnel and patients and then operates under normal procedures. Depending on the medical condition of the patients, the crew may need to coordinate for altitude and flight restrictions and some ground operations considerations.[39] Through the aeromedical evacuation and tactical airlift missions, any C-17 aircrew can provide a unique capability to a combatant commander. Again, this vital capability requires proficiency—proficiency that must be thoughtfully and systemically maintained.

Currently only four of the C-17 main operating bases conduct the airdrop mission.[40] Furthermore, at these four locations the crews qualified for airdrop are also limited. The capability to airdrop focuses on the intra-theater mission of the C-17. Airdrop crews are specifically trained for formation and airdrop procedures. Each

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[37] Air Force, "C-17 Globemaster III," Fact Sheet, 29 December 2011.

[38] Air Force Instruction (AFI) 11-2C-17 Volume 3, *C-17 Operations Procedures*, 16 November 2011, 187.

[39] AFI 11-2C-17 Volume 3, *C-17 Operations Procedures*, 225-231. Chapter 20 provides crew procedures for aeromedical evacuation operations.

[40] Joint Base Charleston, South Carolina and Joint Base Lewis-McChord, Washington are the only two C-17 main operating bases to conduct airdrop operations. Airdrop training is accomplished at the C-17 flying training unit, Altus Air Force Base, Oklahoma.

crewmember attends formal training and maintains an extensive training regime to maintain proficiency.[41] The amount of training a pilot can accomplish in the weapon system trainer depends on the experience level, but a new airdrop qualified pilot can accomplish 50 percent of the events. Precision airdrop is another capability the C-17 provides. The Joint Precision Airdrop System (JPADS) utilizes atmospheric data, and Global Positioning Systems (GPS) receivers and actuators to steer the bundle's parachute to the exact location.[42] This type of airdrop requires additional continuation training and certification to ensure safe employment. Airdrop missions expanded since the start of Operation Enduring Freedom. In 2011, "mobility Airmen airdropped more than 80 million pounds of cargo for troops deployed throughout austere locations in Afghanistan."[43] This statistic includes C-130 airdrop, but the C-17 has proven its utility in the airdrop mission; and, as combat operations begin to end with the exit from Afghanistan, airdrop will continue to provide an integral capability to the Department of Defense.

The C-17 possesses a few smaller, unique capabilities: Special-Operations Low-Level (SOLL) II, Primary Nuclear Airlift Force (PNAF), and Operation Deep Freeze support missions.[44] These niche capabilities require extensive training and specialization that fall outside the discussions of this study. All of the C-17's unique missions are joint requirement driven and the aircrews train to execute these missions to perfection. The C-17 communities' contribution to the airlift mission and the future is beyond reproach. The leadership of the Department of Defense and the Air Force need to create an environment for airmanship training and remain committed to solving the "proficiency puzzle" despite the current fiscal restraints. Within current restraints, what actions can Air Mobility command take to manage risk, maintain capability and increase airmanship?

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[41] AFI 11-2C-17 Volume 1, C-*17 Aircrew Training*, 39-40. See appendix A, table 4.4 for continuation training flying requirements for airdrop pilots.
[42] Air Mobility Command Public Affairs, "C-17 employs 'screamer' in combat airdrop," *U.S. Air Force News*, 25 May 2007, http://www.af.mil/news/story.asp?id=123054785.
[43] Air Mobility Command Public Affairs, "Airdrops could play key role in eventual Afghanistan transition," *U.S. Air Force News*, 17 April 2012. http://www.af.mil/news/ story.asp?id=123298387
[44] AFI 11-2C-17 Volume 1, C-*17 Aircrew Training*, 58-60. This section describes the requirements and qualifications for the SOLLII, PNAF, and Operation Deep Freeze missions.

SYNTHESIS AND RECOMMENDATIONS
From the Past, Leadership for the Future

> *Valuable time was wasted in Berlin as crews landed, parked, shut off engines, took off for the snack bar and then strolled over to Operations to make out their return clearances. I laid down an order: No crewmember was to leave the side of his aircraft while the Germans unloaded it. Each plane would be met by an operations officer who would hand the pilot his return clearance all filled out, and a weather officer would give him the latest weather back at his home base. Mobile snack bars tended by some of the most beautiful girls in Berlin would move to the side of each plane. Turn-around time was cut in half to 30 minutes.*
>
> General William H. Tunner

The Air Force invests over two years and $1.2 million for a C-17 pilot's initial training. During these two years of intense training, a student pilot participates in 331 training days and 222 sorties (simulator or aircraft), translating to an average of a sortie every three days. This repetition is integral to a strong foundation in flight discipline, skill, and knowledge building towards proficiency. Furthermore, the Air Force has invested millions of combat and training hours into upgrade training, currency, and seasoning the entire C-17 pilot community. In the future, the lack of fiscal resources, coupled with the drawdown in USTRANSCOM's missions, will likely result in substantially fewer flying hours. The program of record for C-17 total flying hours in FY 13 is 100,816 hours, which is 22,615.1 hours less than actually flown in FY 12.[1] As this work has outlined, there is a correlation between quantity of flying training and proficiency. As the variance between these elements change, the Air Force will have to contend with a third variable—risk. What risk is the Air Force willing to take in regard, to the development and proficiency of its C-17 pilot community?

The flying community is not risk adverse; flying is an inherently risky. Starting with the first emergency scenario of pilot training the curriculum emphasizes risk mitigation. A pilot's first programmed response is, "I have the aircraft, I will maintain aircraft control, analyze the situation, take the appropriate action, and land as soon as conditions permit." Thorough, rigorous, repetitive training that results in a proficient

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[1] Air Mobility Command A3TR, "C-17 FY00-13 Flying Hour Program," Excel Spreadsheets, compiled 20 January 2013. The active duty AMC C-17 community flew 123,431.1 hours in FY 12.

pilot force is one way to mitigate risk. Therefore, how should the Air Force solve the "proficiency puzzle" for its mobility pilots given the simultaneous drawdown in resources for training and apportionments for mission experience?

<u>Recommendations</u>
1. Individual Proficiency Model

Pilots must take responsibility for their proficiency; maximizing each training opportunity for continuous improvement. Developing proficiency is different for every pilot. Psychologically, pilots "are in it because it's their way of life. They are in it because they want to be; they do not want to be in anything else and would probably be happy to fly, even if they were not getting paid for it – well, almost! It's not really a job, it's part of one's life."[2] Pilots want to fly; it is why many pilots joined the Air Force. The Air Force needs to take this underlying psychological drive, which started the first day of pilot training, and continue to cultivate it. Pilots must have the opportunities to continue to develop the framework for proficiency: flight discipline, skill, and currency. These foundational elements provide the rigidity needed to build proficiency. Integrated inside the foundational framework the six attributes of knowledge (self, aircraft, mission tactics, crew resource management, environment, and risk) require dedicated development. These six integrated attributes coupled with a foundational framework allow a pilot to solve the "proficiency puzzle" by building, judgment and situational awareness. When presented with opportunities to develop these attributes and expand proficiency, a pilot must capitalize on each training event, especially in the future constrained environment.

Proficiency is a perishable skill and requires persistent development. Organizationally, the Air Force equates continuation-training currency with proficiency. A current pilot is not necessarily a proficient pilot. An overemphasis on the objective portion of proficiency diminishes the personal responsibility proficiency demands; currency is only one piece of the puzzle. "Research shows that [pilots] lose [their] mental, or cognitive, piloting skills as fast or faster than [their] physical ones. In fact,

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[2] S. J. Sloan and C.L. Cooper, *Pilots Under Stress* (New York, NY: Routledge & Kegan Paul, 1986, 183.

since flying is a psychomotor process, it is by definition a blending of mind and body to achieve results."[3] The constraints of the future will decrease the amount of "hands-on" flying each pilot will receive; therefore, mental skills need to be aggressively maintained. In pilot training, the Air Force invests over 400 hours on formal ground or academic training, and this practice needs to continue throughout a pilot's career. Academic training, walking through a mission (chair flying), and discussing real-life scenarios (hangar flying) provide an avenue for developing mental flying skills. Mental-skills training can specifically focus on multiple pieces of the proficiency puzzle in an informal environment. These mental training exercises can help increase effectiveness during currency events and maintains a focus on proficiency. Pilots' tend to concentrate on the metrics measured by higher headquarters, but need to focus on maximizing proficiency training during each event. Pilots need to remember, "Continuous improvement is not about being right or wrong. It is about the rigorous reflection that leads to that place where we know more than we used to so we do better today and get better tomorrow."[4] The Air Force provides pilots training opportunities, but ultimately pilots are responsible for their training and must maximize preparation and execution during training to achieve proficiency.

2. Operations Group Training Focus

One way to facilitate individual proficiency is to empower the operations group leadership to execute a flying-hour program focused on specific capabilities needed to fulfill the command's requirements. AMC already provides the directed minimum amount of currency required as a starting point. In addition to the minimum currency, the command needs to provide clear guidance of the capability requirements for the group. Finally, AMC needs to provide the group with enough flying hours to fulfill the required capability effectively. After receiving the currency minimums, clear capability guidance, and flying hours, an operations group commander can ensure efficient use of different

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[3] Tony Kern, *Redefining Airmanship,* (New York, NY: McGraw-Hill, 1997), 63.
[4] Tony Kern, *Professionalism*, Bombardier Safety Standdown USA, 2011, http://www.safetystanddown.com/ knowledge-center/videos/. Last slide in Dr. Kern's presentation.

mediums: simulator, aircraft, computer based training, and hangar flying, to achieve and maintain a proficient crew force.

The current C-17 guidance holds the squadron commander responsible for the proficiency of the squadron, but the commander has lost the flexibility in training. Through an empowered operations group, the leadership would have the tools and flexibility to fulfill the required capability for AMC. The best course of action is to meet the individual pilot's proficiency requirements. As this work has emphasized, proficiency requires objective and subjective measurements. AMC provides tools to objectively measure proficiency through continuation-training currency requirements and a standards guide. In addition to these tools, the subjective measurement occurs through the instructor and evaluator pilots. Empowered instructor and evaluator pilots need to provide the squadron commander and group commander honest feedback on a pilot's proficiency. The instructor and evaluator crew force provides the assessment required to inform efficient use of training. The reality of the current fiscal and mission constraints points to maximum simulator usage. Unfortunately, a pilot who is struggling in the aircraft, depending on the deficient procedural area may not require more simulator time, but needs repetition in the aircraft. A simulator can help gain some confidence before returning to the aircraft, but skill and discipline in the aircraft is a requirement for proficiency. Conversely, a proficient pilot probably only requires the minimum currency events in the airplane and can maintain proficiency in the simulator. Pilots' training requirements are similar to a bell-shaped curve of human-behavior. Some pilots require more training to gain and remain proficient while others require less, but the majority of pilots fall in the middle of the bell curve. The area under the curve is the amount of training resources the operations group needs to maintain a proficient pilot force. In today's environment, AMC will provide a limited number of flying hours to the operations group and it is the operations groups job to utilize these hours efficiently and effectively. In addition to an aircraft flying hour program, operations group leadership will need to supplement other mediums of training similar to the ones used in pilot training and at the C-17 flying training unit. Each pilot needs a tailored training program. A pilot's training program must incorporate the AMC established minimums and using multiple mediums to solve an individual's "proficiency puzzle." The most effective

method to determine individual requirements is through the honest feedback of the instructor and evaluator crew force. Many of these pilots have other important jobs across their wing and group, but their responsibility is to maintain the highest level of personal proficiency and strive to provide open and honest feedback on overall crew force proficiency. An empowered operations group and squadron can focus and tailor individual proficiency and provide AMC an effective and efficient use of resources to achieve required capabilities under fiscal constraints.

3. Specialized Mission Requirements and Prioritization

The unique missions of the C-17 are extremely important, however, during times of fiscal reduction, these specialized mission sets require prioritization. Mission-set reduction will drive an assumption of risk, management of scarce resources, and possibly a decrease in capability. Similar to funding the budget, specialized mission requirements represent a zero sum game. If C-17 pilot proficiency and training is going to be a priority; specialized mission requirements must change. AMC in conjunction with USTRANSCOM must evaluate mobility requirements and determine the best areas to assume risk—in specialized mission capability or training.

One possible area AMC could take risk and redistribute flying hours is to decrease the number of crews qualified in air refueling. Currently, every aircraft commander is qualified to accomplish air refueling. Air refueling is not unique to the C-17. It is a force multiplier and operationally provides flexibility and global reach, but a cost-benefit analysis is required. For a new air-refueling qualified aircraft commander the continuation training requires one receiver air refueling event every 45 days and six events every semi-annual period.[5] Half of these events may be accomplished in the simulator, leaving three events for the aircraft, and one must be at night and two must have the tanker's auto-pilot off.[6] Three separate sorties are required for these three

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[5] Air Force Instruction (AFI) 11-2C-17 Volume 1, *C-17 Aircrew Training*, 1 June 2012, 38. Table 4.4 see appendix A.

[6] AFI 11-2C-17 Volume 1, *C-17 Aircrew Training*, 103. Tanker autopilot off air refueling event replicates a scenario where air refueling with "a tanker with an inoperable autopilot" is required. The tanker is a unstable platform compared to when the tanker's autopilot is on.

aircraft events and, as a guide, require remaining in the contact position for five minutes.[7] Air refueling tracks vary in length, but generally 45 to 90 minutes, and the first contact averages 10 minutes into the track. If each pilot that requires a five-minute contact and takes an average of five minutes to get into and out of the seat, close to contact, and back out from contact, a crew can accomplish five air refueling events in a 60-minute air-refueling track. A single C-17 squadron is authorized 36 crews, which means the least amount of aircraft commanders a squadron can have is 36.[8] The flying-hours example presented in the Air Force Instruction authorizes 50 percent aircraft commanders as inexperienced (flight level C), therefore 18 aircraft commanders must accomplish three air-refueling events per semi-annual period in the aircraft.[9] Assuming each pilot needs approximately 10 minutes to accomplish one currency event, the squadron will need 540 minutes of air refueling training in a semi-annual period. This is just the continuation training for the inexperienced air-refueling-qualified aircraft commanders. If the remaining 18 aircraft commanders' requirements are calculated, the squadron needs an additional 300 hours or almost 17 air-refueling tracks. The total cost to keep a squadron of 36 air-refueling qualified aircraft commanders' current, in the aircraft for the minimum amount of contacts, and perfect execution is $250,544 per semi-annual period. Table 8 depicts these estimates and calculations.

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[7] AFI 11-2C-17 Volume 1, *C-17 Aircrew Training*, 102. The contact position is where the tanker and C-17 are connected through the boom and fuel could be passed from the tanker aircraft.

[8] Department of the Air Force. "A36-1 Authorized Aircrew Composition (Regular)." Air Force Portal, Financial Management, AFI 65-503, Cost Factors: Factors Tables. https://www.my.af.mil/gcss-af/USAF/ep/browse.do?categoryId=p6925EC1 63B560FB5E044080020E329A9&channelPageId=s6925EC1350500FB5E044080020E3 29A9 (accessed 19 March 2012) The C-17 crew ratio is 3.0 and the authorized aircraft at a single squadron base (Travis Air Force Base, California; Dover Air Force Base, Delaware; Joint Base McGuire-Dix-Lakehurst, New Jersey) is 12, resulting in an aircrew requirement of 36.

[9] Air Force Instruction (AFI) 11-102, *Flying Hour Program Management*, 30 August 2011, 14. "AP1 Level C pilot authorization as percentage of API 1 aircract commander authorizations – 50%."

Table 8. C-17 Air Refueling Cost Estimate

Aircraft Commander Training Level	Number of Pilots	Required Aircraft AR Events (per semi-annual period)	Time Req'd (mins)	Total Mins for Sq	Cost Per Experience Level (60 mins = $17,896)
A (Highly Experienced)	6	1	10	60	$17,896
B (Experienced)	12	2	10	240	$71,584
C (Mission Ready - Inexperienced)	18	3	10	540	$161,064
Totals:	**36**			**840**	**$250,544**
Air Refueling tracks (60 minutes long) with 5 contacts per track:				**16.8**	

Source: Adapted from AFI 11-2C-17 Volume 1, C-17 Aircrew Training, 38 and Air Mobility Command A3TR, "FY13 AMC C-17 cost for one training hour," email correspondence, 11 March 2013.

This calculation is a simplified example of the investment air refueling capability costs AMC. $250,544 is not a lot to invest and maintain the flexibility provided by air-refueling capability, but this is only for one of 11 AMC active duty C-17 squadrons. Additionally, this calculation is for the minimum number of aircraft commanders at one of the single-squadron bases. This is only a fraction of the cost to maintain every aircraft commander as an air-refueling-qualified pilot. A future study needs to first analyze the requirements for the C-17's air-refueling capability and then determine how many crews can fulfill the requirement. A planning factor is required to provide flexibility for the 618th TACC and war planners. One option would be to qualify all aircraft commanders and then maintain a few fully qualified and keep a reserve of simulator-currency-only aircraft commanders. If a contingency created a requirement where more air-refueling-qualified pilots were required the generation time would be less than to regain proficiency, versus a full-qualification course. Identifying possible efficiencies in air-refueling requirements and training can provide additional airmanship training opportunities.

In addition to air refueling, the C-17 provides precision airdrop, tactical approaches and assault landings to austere airfields, and night-vision-goggle capability. These specialized missions focus on the joint fight and provide a capability required by joint combat plans. In the current operations, airdrop and tactical night-vision-goggle approaches and departures to austere airfields are unmatched for the United States warfighter support. "Airmen performing airdrops over Afghanistan for OEF [Operation Enduring Freedom] in 2011 have averaged more than 6.1 million pounds dropped per month."[10] These supplies are essential for the current fight, but the future is beginning to take shape and each of these unique capabilities requires expensive training events. The Air Force needs to engage with its joint partners and determine the capabilities requirement for the future. These capabilities require realistic expectations supported by requirements calculations and cost-versus-benefit analysis. This is an area for future study and risk assessment. A majority of the continuation training for these mission sets is creditable in the simulator, but the interaction with the joint partners is essential to the success of these missions.[11] Additionally, the joint partners also require continuation training to ensure joint readiness. Finally, a reduction in capability creates a scarcity issue for AMC and the 618th TACC. Due to the reduced scheduling flexibility, TACC must develop a new strategy for aircraft and crew employment. These unique capabilities have proven essential during recent combat operations, but the constraints of the future demand an in-depth analysis, risk assessment, and future mobility air forces strategy. Ultimately, the future AMC strategy requires prioritization of the C-17's specialized missions.

4. Crew Ratio Reduction

The results of the specialized mission requirements and prioritization analysis could enable a reduction in the C-17 crew ratio. The crew ratio for the C-17 is 3.0 crews to every aircraft and has been since the C-17's first flight in 1994. With the upcoming

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[10] Master Sergeant Scott T. Sturkol, "10 years of Enduring Freedom: Since the first day, airdrops in Afghanistan have made a difference," *Air Mobility Command News*, 5 October 2011, http://www.amc.af.mil/news/story.asp?id+123274807.

[11] AFI 11-2C-17 Volume 1, *C-17 Aircrew Training*, 40. See appendix A for Table 4.4: NVG, formation, and airdrop events continuation training requirements.

mission reduction by USTRANSCOM can AMC fulfill the mobility requirement with fewer C-17 crews? During the past 13 years of combat operations, the C-17 has been a workhorse and the 3.0 crew ratio was definitely required, but the circumstances are changing. The current budget and personnel costs are driving a transformation. If the crew ratio is decreased to 2.75 or 2.5 what is the result in the capability of the community? What is the fiscal savings? In AMC, the C-5 crew ratio is 1.8, the C-130J is 2.75, and the KC-10 is 2.0. If a reduction is possible, this would decrease the number of training-event requirements across the community, flying hours required, and would increase available simulator time for currency and skill development. In order to provide the community time to adjust to the experience-level change the reduction should not occur rapidly. The C-17 crew ratio requires additional analysis of mobility requirements and cost-benefit to determine the most effective ratio.

5. Accelerated Copilot Enrichment Program

The Accelerated Copilot Enrichment (ACE) program is an opportunity for a C-17 pilot to gain attributes of proficiency through experience. This program is currently operated in the B-2 and U-2 communities utilizing T-38 aircraft. For the mobility air forces, the copilots could fly the T-1 or T-6 at a fraction of the cost of a C-17 training hour.[12] However, these hours do not replace the invaluable C-17 primary time. Primary time should remain the focus of upgrade requirements, because experience in one aircraft is not a direct correlation to proficiency in another. The ACE program's training flights would concentrate on developing flight discipline, basic skill, and general knowledge. The program delivers a mobility pilot an inexpensive way to build flying hours and some of the foundations of the "proficiency puzzle" in a real-time environment. ACE provides pilots a similar psychological environment unlike the simulator, but does fail to enhance the students' knowledge of the C-17, training in the specialized missions of the C-17, and C-17 flying skill. The ACE program requires a cost-benefit analysis for the buying,

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[12] Department of the Air Force, "A4-1 Logistics Cost Factors," Air Force Portal, Financial Management, AFI 65-503, Cost Factors: Factors Tables, https://www.my.af.mil/gcss-af/USAF/ep/browse.do?categoryId= 6925EC163B560FB5E044080020E329A9 &channelPageId=s6925EC1350500FB5E044080020E329A9 (accessed 19 March 2012). T-1 cost per flying hour is $1,310 and the T-6 cost per flying hour is $474.

maintaining, and training in another aircraft at a C-17 main operating base. The cost per hour is enticing and only a few hundred dollars more than the C-17 simulator, but the support and logistics could remain cost prohibitive. An extrusive consideration for developing an ACE program within the C-17 community is important.

Commercial Airlines Model

AMC is often questioned about the commercial airliners training model and why it does not fit the mobility air forces. The commercial airlines accomplish 100 percent of pilot's continuation training in the simulator. The commercial airlines define proficiency similar to the Air Force and the pilots train to similar standards. Instructor pilots in the airlines have similar objective parameters complemented by an experienced-based subjective analysis of a pilot's proficiency. The parallels between the two flying organizations are immense, but the differences drive a complex training strategy. First, the commercial pilots, flying aircraft similar to the C-17, have experience before starting training. The larger carriers, Delta, United, and Southwest all have similar requirements, between 1,500 and 2,500 total flight hours, 1,000, and 1,500 hours of fixed wing turbine flight time.[13] This experience establishes a strong foundation, a solid general knowledge base, and expands situational awareness and judgment ability.[14] These pilots are seasoned compared to a new C-17 pilot. Second, the commercial pilot's standard mission is takeoff from one airport fly across the United States or the world and land at another airport. Weather and emergencies are the largest threats and there are no unique missions, only unique locations, which the simulator can depict. The commercial airline's mission is difficult, but pilots fly regularly and exercise the same maneuvers each flight. The repetition from the pilot's initial training in the simulator is reinforced in the aircraft every flight. Finally, airline pilots fly multiple trips a month, especially the new pilots building seniority. In contrast, a C-17 pilot must be trained and flexible to fly

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[13] United Airlines Pilot Positions, "Flight Time Requirements," United Airlines, http://www.airlineapps.com/Intro/United. Southwest Airlines Pilot Application Requirements, "Flight Experience," Southwest Airlines, http://www.southwest.com/html/about-southwest/careers/positions/pilots.html. Delta Airlines Pilot Basics, "Flight Time Requirements," Delta Airlines, http://www.deltajobs.net/pilot_qualifications.htm.
[14] Kern, *Redefining Airmanship*, 22.

to austere airfields, execute a low-level airdrop or air refueling, and fly into combat. These unique mission sets create difficulty for C-17 simulator training. The airline's continuation training currency does have some parallels. Three landings and takeoffs every 90 days is similar to the C-17.[15] Most airlines pilots achieve this currency in the aircraft without requiring additional simulator training. Unfortunately, in the future with constrained resources, more C-17 currency will be forced into the simulator, which does not offer the same quality of training as the aircraft. Through the years, the airlines have increased training and created new tools and techniques used across the aviation industry. One of these training tools is crew resource management. The airline model offers some areas to emulate, but the differences preclude AMC from implementing simulator-only continuation training.

Technology provides the aviation industry with multiple mediums to enhance training, but technology cannot completely replace hands-on flying. For new pilots it is difficult to gain a full understanding of the simulation because of the lack of aircraft experience, but it is perfect for any experience level to practice skills and rehearse scenarios. The simulator pre-briefing is integral to the overall success of the simulator sortie. Intense flight study and procedural discussions in the pre-brief maximize the limited time in the simulator providing effective procedural and skill development.[16] The simulator is a medium created for maintaining and providing confidence for pilots. Simulator sorties solidify proficiency, but pilots need to "practice right." "Experience is a good teacher, but it doesn't always teach good habits, techniques, or procedures. Our experiential development depends largely on with whom we fly and what happens when we fly."[17] When a pilot steps into a simulator, psychologically it needs to be like stepping onto a flight deck. To improve this psychological transition the preparation and intensity needs to reflect an aircraft sortie. The simulator will enhance pilot proficiency, especially given the current restraints, but the training is not sufficient. However, not a sufficient replacement for hands-on flying, the simulator is the most effective medium to

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[15] Charlie Doyle (retired airline pilot.) interview by the author, 7 January 2013. Mr. Doyle has over 25 years of experience as an instructor and 20 years as an examiner on the Boeing 747, 777 and the Airbus 300 for multiple companies.
[16] Charlie Doyle (retired airline pilot.) interview by the author, 7 January 2013.
[17] Kern, *Redefining Airmanship*, 58.

augment aircraft training. When paired with other training mediums (ground based training, hangar flying, chair flying) and limited aircraft flying hours, the operations group leadership and pilots can achieve an individually tailored training program to achieve and maintain pilot proficiency.

Conclusion

      General Welsh challenged, "Every Airman should constantly look for smarter ways to do business…Leaders should empower Airmen to think creatively, find new solutions, and make decisions."[18] The current fiscal challenges and the drawdown of recent combat operations have presented a unique opportunity in AMC's history. During times of fiscal restraints and reconstitution, a new strategy is required. One area AMC needs to research further is the C-17 specialized missions. The C-17 is an extremely capable aircraft and provides niche mission sets to AMC and USTRANSCOM, but at a premium price. What are the specialized mobility requirements after the drawdown in Afghanistan? What are the risks associated with less aircraft training and more simulator sorties? One of the first steps that is vital to the attack on the "proficiency puzzle," is a future mobility requirements study. The mobility strategy and requirements for future operations will provide answers to the "proficiency puzzle," and may help determine the specific training attributes for individual pilots. These questions are difficult and the answers are not simple, but like Lieutenant General Darren W. McDew, 18th Air Force commander said, "I tell our people that the answers of how to move forward are with them. These Airmen have worked hard over the last 11 years of war. They've got all the right answers."[19] These Airmen can solve the "proficiency puzzle." Now all we have to do is listen!

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[18] Gen Mark A. Welsh, III., "A Vision for the United States Air Force." E-mail. Washington, DC, 10 January 2013, 4.
[19] Colonel Greg Cook, "An Interview with Lt Gen Darren McDew, 18AF/CC," *Airlift/Tanker Quarterly (A/TQ)* 21, no. 1 (Winter 2013): 15. http://www.atalink.org/ATQ/Issues/ATQ_Winter_2013.pdf (18 March 2013).

APPENDIX A
C-17 Continuation Training Tables

(Reprinted from, Air Force Instruction (AFI) 11-2C-17 Volume 1, *C-17 Aircrew Training*, 1 June 2012, 30-32, 35-41.)

Table 4.1. Aircrew Ground Continuation Tng Reqs.

Code	Event	Position	Freq	Reference Directive	Notes
(Failure to Accomplish = NMR).
	Flight physical	All	455d	AFI 44-170	1,7,8,11
	Physiological training	All	60m	AFI 11-403	1,7,8
G060	Tactics	All	SA		2,4,5,10
G070	Aircrew Intelligence	All	A	AFI 14-105 w/supp AFI 14-202v1	2,4,7,10
G080	Comm Procedures	P	365d	AFI 33-201v2	2,10
G090	Antihijacking	All	B	AFI 13-207	2,7
G130	Instrument Refresher	P	4Q	AFMAN 11-210	6,7
G182	Hazardous Cargo Training	All	A	AFMAN 24-204	2
G230	CRM Refresher	All	A	AFI 11-290	4,7
G251-G254	Airland Phase CBTs	All	Q	Chapter 4	1,12
G256-G259	Airdrop Phase CBTs	All	Q	Chapter 4	1,3,12
LL03	Egress Training, Non-Ejection	All	T	AFPD 11-3 AFI 11-301	1,7
LL06	Aircrew Flight Equipment (AFE)	All	T	AFI 11-301	4,9
NV03	NVG Refresher	All	24m	AFI 11-202v1	4,7
SS02	Combat SERE Training (CST)	All	36m	AFI 16-1301	2,7, 10
SS04	Non-Combat SERE Training	All	36m	AFI 16-1301, AETC Sup	7,13
SS05	Water Survival Training (WST)	All	36m	AFI 16-1301	2,7
SS06	Emergency Parachute Training (Refresher)	All	36m	AFI 16-1301	1,7

See "Frequency" in Attachment 1
Notes:
1. Mandatory grounding event after expiration date. Crewmembers will not fly until completion.

2. Not required for BMC crewmembers.
3. Dual log with airland phase CBTs.
4. The OG/CC or equivalent is the waiver authority for this event.
5. OG/CCs may specify an alternate frequency for Tactics training, but not less than "annual".
6. This event does not satisfy the IRC examination requirement within the check cycle.
7. AFI 11-2(MDS)v1 is not the governing directive for completion of this event. IAW AFI 11-202 Volume 1, Paragraph 6, refer to HQ USAF/A3OT reference publications for current ancillary training frequencies.
8. This event is independently tracked via the crewmember's Individual Training Summary (ITS) and thus does not require an ARMS code.
9. LL06 may be accomplished in conjunction with SS02, LL03, or SS05. See **Chapter 7.**
10. Local sorties/CONUS Training Missions may be accomplished unsupervised while non-current for this event.
11. Mandatory grounding item; individual will not fly until required training is accomplished. Flight physicals become due 366 calendar days after the previous physical, and expire after the 455th day or as indicated on the AF IMT 1042, whichever occurs first. The required frequency may vary to address waivers and/or individual physical limitations (as determined by the AMDC/CC), but in no case will exceed 455 calendar days.
12. Phase CBTs must be accomplished prior to the current period's Phase WST training (AFRC and NGB crewmembers should accomplish Phase CBTs prior to Phase WST training, but the sortie will not be canceled if not accomplished).
13. Applies only to AETC FTU instructors non-current in SS02.

Table 4.2. Aircrew-Specific Mobility Training Requirements.

(If Non-Current, Restrictions May Apply).				
Code	Event	Frequency	Reference Directive	Notes
C040	Mobility Folder Review	AR	AFMAN 10-401 AFI 36-507	3
E030	Passport	AR	Foreign Clearance Guide	
E035	Secondary Passport	AR	Foreign Clearance Guide	
G010	CBRNE Defense Training	24M	AFI 10-2501	
G050	PNAF Training	A	AFI 11-237	1,3
G120	ISOPREP Review	AR	AFI 14-202v1	
G280	Small Arms Training	24m	AFI 36-2226 AFI 31-207	5
LL04	Aircrew Chemical Defense Training (AERPS)	B	AFI 11-301 and AFI 36-2226	3,4
SS03	Conduct After Capture (CAC)/High	36m	COCOM Guidance	

	Risk of Isolation			
SS07	Contingency SERE Indoctrination	AR	AFI 16-1301	3
VT03	VTRAT Refresher	A	Chapter 4	2,3

See "Frequency" in Attachment 1
Notes:
1. PNAF qualified crewmembers only.
2. See event description in **Chapter 7** for additional information on currency cycle requirements.
3. The OG/CC or equivalent is the waiver authority for this event.
4. Can be dual logged with CBRNE if in compliance with the **Chapter 7** description.
5. AFRC and ANG crewmembers will comply with AFI 36-2226, Combat Arms Program, requirements.

Table 4.3. Flight Surgeon Continuation Training and Mobility Requirements.

(Failure to Accomplish = Restrictions May Apply; events may restrict crewmembers' ability to participate in missions requiring the event).

Code	Event	Freq	Reference Directive	Notes
	Flight Physical	455d	AFI 44-170	1,5,6
	Physiological Training	60m	AFI 11-403	1,6
C040	Mobility Folder Review	AR	AFMAN 10-401 AFI 36-507	2,4,6
E030	Passport (Primary)	60m	Foreign Clearance Guide	2,6
E035	Passport (Secondary)	AR	Foreign Clearance Guide	2,6
FF00	Flight Surgeon Sortie	60d	AFI 11-202v1	
FF11	Day Sortie	6 per SA	AFI 11-202v1	8,9
FF12	Night Sortie	SA	AFI 11-202v1	8,9,10,11
G090	Anti-Hijack Training	One-time		3,6
G120	ISOPREP	180D	JP 3-50	2,6
G230	CRM, Refresher	A		3,4,6
LL01	Aircrew Flight Equipment Familiarization Training	AR	AFI 11-202v1	4
LL03	Egress Training, Non-Ejection	B	AFI 11-301v1	1,6
LL04	Aircrew Chemical Defense Training (ACDT)	One-time	AFI 11-301v1	2,3,4,6
LL05	Egress Training, w/ACDE	One-time	AFI 11-301v1	2,4,6

69

Table 4.4. C-17 Pilot Semi Annual Continuation Training Flying Requirements.

Code	Event	Aircraft Commander (FPL+)					Pilot (FPQ)					Creditable in WST			
		A	B	C	E	CUR	A	B	C	E	CUR	% or Qty	Maintain	Regain	Notes
	Airland Events														
M030	Oceanic Sortie	A	A	A			A	A	A				No	No	13
M040	PNAF Sortie					180 Calandar days					180 Calandar days		No	No	2
M050	Basic Tactical Sortie														
M055	Day Low-Level	1	1	1			1	1	1			100%	Yes	Yes	
M070	Instructor Tactical Sortie	2	2	2		180 Calendar days	4	4	4		180 Calendar days		No	No	4
G240	CRM Simulator					A					A	100%	Yes	Yes	
G250	Proficiency Sim	1	1	2		SA	1	1	2		SA	100%			12, 13, 14, 15
G261-264	Airland Phase Sims					Q					Q	100%	Yes	Yes	9, 11, 12
G294	Instrument Sim Sortie			2		Q	2	4	4		Q	100%	Yes	Yes	7

70

Code	Event	Aircraft Commander (FPL+)					Pilot (FPQ)					Creditable in WST			
		A	B	C	E	CUR	A	B	C	E	CUR	% or Qty	Maintain	Regain	Notes
VT06	Threat Response	1	2	2			1	2	2			100%	Yes	Yes	
P020	Takeoff	8	10	12	6	M	8	10	12		M	100%	Yes	Yes	5
P028	Right Seat Takeoff											100%	Yes	Yes	
P029	Left Seat Takeoff						2	3	3		Q	100%	Yes	Yes	
P198	Right Seat Landing											100%	Yes	Yes	
P199	Left Seat Landing						2	3	3		Q	100%	Yes	Yes	
P260	Have Quick	A	A	A			A	A	A			100%	Yes	Yes	1
P270	Secure Radio Operation	A	A	A			A	A	A				No	No	
P280	ACDTQT	T	T	A			T	B	A			100%	Yes	Yes	
P070	Instrument Approach	6	8	12	6	M	8	10	12		M	100%	Yes	Yes	5
P100	Precision Approach	3	4	6	2		3	4	6			100%	Yes	Yes	
P110	Non-precision Approach	3	4	6	1		3	4	6			100%	Yes	Yes	
P116	NDB	1	1	1			1	1	1			100	Yes	Yes	

71

Code	Event	Aircraft Commander (FPL+)					Pilot (FPQ)					Creditable in WST			
		A	B	C	E	CUR	A	B	C	E	CUR	% or Qty	Maintain	Regain	Notes
	Approach											%			
RS00	Tactical Arrival	2	2	4		Q	2	4	4		Q	100 %	Yes	No	
RS06	High Altitude Tactical Arrival	1	1	1			1	1	1			100 %	Yes	No	
RS16	Low Altitude Tactical Arrival	1	1	1			1	1	1			100 %	Yes	No	
RS20	Tactical Departure	2	2	4		Q	2	2	4		Q	100 %	Yes	No	
P120	Category II Approach	1	1	1			1	1	1			100 %	Yes	Yes	
P118	RNAV Approach	2	2	2			2	2	2			100 %	Yes	Yes	
P130	Circling Approach	1	2	2			1	2	2			100 %	Yes	Yes	
P121	Msn Computer Approach	1	1	1			1	1	1			100 %	Yes	Yes	
P190	Landing	8	10	12	6	M	8	10	12		M	100 %	Yes	Yes	5
P192	Night Landing	2	2	2		Q	2	2	2		Q	100 %	Yes	Yes	
AS11	Landing, LZ	4	4	8		Q	4	4	4		Q	50 %	Yes	No	5,6

72

Code	Event	Aircraft Commander (FPL+)					Pilot (FPQ)					Creditable in WST			
		A	B	C	E	CUR	A	B	C	E	CUR	% or Qty	Maintain	Regain	Notes
AS12	Landing, LZ Nt	1	1	2			1	1	1			100 %	Yes	No	5,6, 10
AS21	Heavy Wt Full Flap	1	2	2			1	2	2			100 %	Yes	Yes	6
AS22	Heavy Wt Full Flap, Night	1	1	1			1	1	1			100 %	Yes	Yes	6
	Air Refueling Events														
R01 0	Receiver AR	3	4	6		A/B- 60d C- 45d						A/B-2 C-3	Yes	No	5,8
R02 0	Receiver AR (Night)	2	2	2		B/C- Q						A- 100% B/C- 50%	Yes	No	5
R05 0	Rcvr AR, Tanker AP Off	1	2	2		B/C- Q							No	No	
	NVG Events														
NV0 0	NVG Low Level	1	1	1			1	1	1			100%	Yes	Yes	
NV4 7	NVG Takeoff	2	2	4		Q	2	2	4		Q	100%	Yes	Yes	
NV4 8	NVG Landing	2	2	4		Q	2	2	4		Q	100%	Yes	Yes	
NV4 9	NVG Landing,	2	2	4		Q	2	2	4		Q	50%	Yes	No	6

Code	Event	Aircraft Commander (FPL+)					Pilot (FPQ)					Creditable in WST			
		A	B	C	E	CUR	A	B	C	E	CUR	% or Qty	Maintain	Regain	Notes
	LZ														
NV80	NVG Instrument Approach	1	1	1			1	1	1			100%	Yes	Yes	
	Formation Events														
F080	AD Visual Wing	2	2	2			2	2	2			50%	Yes	Yes	1
F100	AD Vis Night Wing	1	1	1			1	1	1				No	No	
F110	AD SKE/FFS Lead	1	1	1			1	1	1			100%	Yes	Yes	
F130	AD SKE/FFS Wing	1	1	1			1	1	1			100%	Yes	Yes	
F135	AD Multi-Elm SKE/FFS	1	1	1			1	1	1			100%	Yes	Yes	
F136	AD Multi-Elm Vis	1	1	1			1	1	1			100%	Yes	Yes	1
R015	Formation Air Refueling	1	1	2			1	1	1			100%	Yes	No	1
	Airdrop Events														
G266 - 269	Airdrop Phase Sims					Q					Q	100%	Yes	Yes	9,10,11,12

Code	Event	Aircraft Commander (FPL+)					Pilot (FPQ)					Creditable in WST			
		A	B	C	E	CUR	A	B	C	E	CUR	% or Qty	Maintain	Regain	Notes
AD01	AD Event	2	2	2		Q	2	2	2		Q	50%	Yes	Yes	
AD03	Heavy	1	2	2			1	2	2			A-100% B/C-50%	Yes	Yes	
AD04	CDS	1	2	2			1	2	2			100%	Yes	Yes	
AD05	Personnel	1	2	2			1	2	2			A-100% B/C-50%	Yes	Yes	
AD09	JPADS Med/High Alt	1	1	1			1	1	1			100%	Yes	Yes	3, 16
AD11	PADS Operator Unguided	2	2	2			2	2	2			50%	Yes	No	3, 16
AD12	PADS Operator Guided	2	2	2			2	2	2			50%	Yes	No	3, 16
AD95	Dual Row	1	2	2			1	1	1			100%	Yes	Yes	3
NV18	NVG AD Event	1	1	1			1	1	1			100%	Yes	Yes	

See "Frequency" in Attachment 1
Notes:
1. If accomplished in the WST, will only be logged during Distributed Mission Training/Distributed Mission Operation (DMT/DMO) missions linked with another C-17. Units should schedule airdrop phase periods to be conducted in DMO (linked) mode to the maximum extent possible.
2. PNAF qualified crewmembers only.

Code	Event	Aircraft Commander (FPL+)					Pilot (FPQ)					Creditable in WST			
		A	B	C	E	CUR	A	B	C	E	CUR	% or Qty	Maintain	Regain	Notes

3. Required only if certified or qualified in this event.
4. Two of the four Instructor Tactical Sortie (ITS) requirements for pilots may be substituted with Basic Tactical Sorties (BTS) each semi-annual period if required due to instructor availability. One of the two ITS requirements for aircraft commanders may be substituted with a BTS for Expeditionary Airlift Squadron (EAS) deployed crewmembers.
5. Unqualified in the aircraft (unqualified in airdrop for airdrop events) if non-current in excess of 6 months. See Para 4.10.6.2. EXCEPTION: Unqualified status in DRA or JPADS does not affect airdrop currency in other events.
6. 100% of FP requirements may be logged during LZ events while performing Pilot Monitoring (PM) duties and 50% of FP requirements may be logged while performing Go-Around after Touchdowns (GOATs).
7. FTL C airland aircraft commanders who are also airdrop copilots will complete the airdrop phase training lessons plus an ISS each quarter.
8. Pilots may extend AR currency via simulator if current from a previous AR accomplished in the aircraft.
9. WIC Students are exempt from current Phase Simulator Training but must complete CBTs.
10. 50% of this requirement for FTL C aircraft commanders may be accomplished in the WST.
11. The mission scenario of phase training is not required for FTU instructors who maintain BMC.
12. Must be accomplished with at least one qualified Aircraft Commander on the crew. (ARC may substitute an FTL A FPQ for an AC, if needed).
13. SOC, FTL E pilots, FTU instructors and WIC students/cadre are exempt from this requirement.
14. FTL C should accomplish quarterly to the maximum extent possible.
15. SQ/CC or designated representative is the waiver authority for non-consecutive events; OG/CC is the waiver authority for two consecutive events.
16. JPADS qualified crewmembers only.

Table 4.5. Loadmaster Semi Annual Continuation Training Flying Requirements.

Code	Event	Loadmaster					Creditable in LS/WST			
		A	B	C	E	CUR	%	Maintain	Regain	Notes
	Proficiency/Basic Events									
M010	Proficiency Sortie					60d		No	No	1

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